A9 Dualling Programme: Pass of Birnam to Tay Crossing

DMRB Stage 2 Scheme Assessment Report
Volume 1: Main Report and Appendices
Part 3 – Environmental Assessment

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6. Summary of Previous Environmental Assessment

6.1 Introduction

6.1.1 This chapter provides a summary of the previous environmental assessments, and other relevant work, that has been undertaken for the project prior to this Design Manual for Roads and Bridges (DMRB) Stage 2 assessment, which includes:

- DMRB Stage 1 Assessment, A9 Dualling: Preliminary Engineering Support Services (Transport Scotland, 2014a);
- Strategic Environmental Assessment (SEA), Environmental Report, Addendum and Post-Adoption Statement (Transport Scotland, 2013, 2014b and 2014c);
- DMRB Stage 2 level assessment undertaken by AECOM (formerly Scott Wilson/URS) (2009 to 2014);
- DMRB Stage 2 level assessment undertaken by Jacobs (2014 to 2016);
- The A9 Co-Creative Process (2016 to 2018); and
- DMRB Stage 2 level assessment undertaken by Jacobs (2018 to 2020).

6.2 Background to Dualling the A9

6.2.1 The Cabinet Secretary for Infrastructure and Capital Investment launched an Infrastructure Investment Plan (IIP) on 6 December 2011, which provided an overview of the Scottish Government's plans for infrastructure investment over the future decades (Scottish Government 2011; 2015). Contained within the plan was a commitment to complete the dualling of the A9 between Perth and Inverness by 2025. The publication in February 2021 of the most recent Infrastructure and Investment Plan for Scotland 2021-22 to 2025-26 (Scottish Government, 2021) reaffirms the commitment to deliver the phased dualling of the A9 Perth to Inverness Road and that procurement options are being reviewed to bring forward the remainder of the programme on completion of statutory processes.

6.2.2 The A9 corridor forms a strategic link between Central Scotland and the Scottish Highlands, as shown in Figure 1.1. The 177 kilometre route between Perth and Inverness consists of seven single carriageway sections interspersed between eight dual carriageway sections. Approximately 129 kilometres of these single carriageway sections are proposed to be dualled in order to complete the overall dualling of the A9.

6.2.3 The Pass of Birnam to Tay Crossing project commences at the northern extent of the current short section of dual carriageway at the Pass of Birnam. It extends approximately 8.4 kilometres, passing the towns of Birnam, Little Dunkeld and Dunkeld to the east and Inver and The Hermitage, a National Trust for Scotland site, to the west. The tie-in point with the following scheme, Tay Crossing to Ballinluig, is approximately 0.75 kilometres north of the current River Tay crossing.

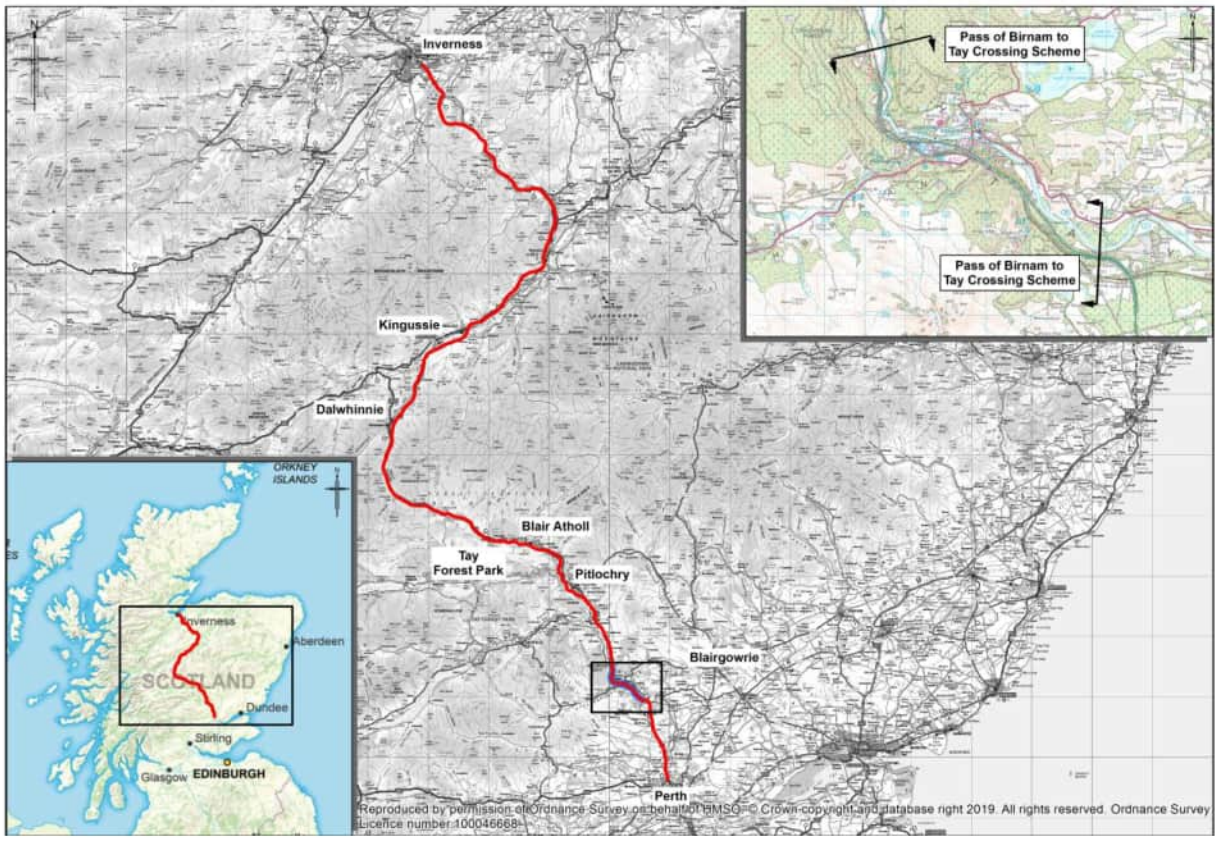

Figure 6.1: A9 Perth to Inverness Location Plan

6.3 Initial Scheme Assessment (2004 to 2009)

6.3.1 In July 2004, Transport Scotland commissioned AECOM to undertake a Route Improvement Strategy Study (RISS) for the new A9 trunk road between Perth and Blair Atholl. This study identified Pitlochry as a definitive split in the character of the route, primarily due to the reduction in traffic volumes north of the town. The study therefore recommended upgrading of the A9 between Perth and Pitlochry to dual carriageway standard and provision of a WS2+1 layout between Pitlochry and Blair Atholl.

6.3.2 In 2006, the Scottish Executive published its National Transport Strategy. The strategy outlined the vision for the country's transport network and the context for transport policy for the next 20 years. One of the mechanisms for delivering the National Transport Strategy was the Strategic Transport Projects Review (STPR), which outlined a programme of transport interventions for the period 2012 to 2022 and beyond.

6.3.3 The STPR recommended upgrading of the A9 from Dunblane to Inverness and confirmed that dualling the A9 would be expected to provide a significant contribution to the Scottish Government's purpose of:

- increasing sustainable economic growth;
- delivering on the national objectives of promoting journey time reductions between the Central Belt and Inverness and reducing accident rates; and
- addressing the A9 corridor specific objectives of improving the operational effectiveness of the A9 on approach to Perth and Inverness and addressing issues of driver frustration.

6.4 AECOM Assessment (2009 to 2012)

6.4.1 In 2009, Transport Scotland commissioned AECOM to progress the development of the Pass of Birnam to Tay Crossing section of the A9 dualling, considering the engineering, environmental and economic impacts of dualling options through further study, design and assessment work. The commission brief identified the main objectives for the scheme which were to;

- improve the operational performance and level of service and road safety on the A9 by reducing the effects of driver stress and journey times;
- examine opportunities for integration of Non-Motorised Users [1] (NMUs) and public transport facilities into the solution;
- mitigate the environmental impact of the new works and, where possible, examine opportunities for enhancing the environment;
- achieve good value for money for both taxpayers and transport users;
- design for ease of practical and safe maintenance;
- minimise disruption/impact to road users, stakeholders, local community and environment during construction; and
- be promotable/deliverable through the statutory processes.

6.4.2 AECOM considered an online corridor for a dual carriageway. Offline corridors, both to the east and the west, were considered, however there were discounted, primarily due to the existing topography within the study area and the resultant environmental impact. It was concluded that an offline route to the east would involve significant tunnelling works through Craig-a-Barns, and an offline route to the west would involve significant tunnelling through Birnam Hill.

6.4.3 The AECOM assessment considered five alternative scheme options, (Options 1, 2, 3, 4 and 5) which are detailed in Volume 1, Part 1 - The Scheme. Each option was based on the same A9 horizontal geometry, with differing mainline vertical profile and junction layouts at three locations (Birnam, Dunkeld and Dalguise) to facilitate turning movements and provide access to Birnam, Little Dunkeld and Dunkeld. The five scheme options considered a reduced standard left-in left-out junction at Dunkeld & Birnam Station, with no car parking facilities. A left-in left-out junction was also provided at The Hermitage.

6.4.4 The assessment of the five options was not concluded and no recommendations were provided due to the need to undertake further consultation.

6.5 Further Scheme Development (2012 to 2014)

6.5.1 Towards the end of the AECOM Assessment (2009 to 2012), the Cabinet Secretary for Infrastructure and Capital Investment launched on 06 December 2011 the Infrastructure Investment Plan (IIP) (Scottish Government, 2011). This Plan reinforced the Scottish Government's commitment to completing the A9 Dualling Programme between Perth and Inverness by 2025.

[1] These objectives were developed when NMU was the terminology used in the DMRB. In this DRMB Stage 2 report, the term walkers, cyclists and horse-riders (WCH) is more commonly used to describe this group as it is the term used in the revised DMRB guidance.

Strategic Environmental Assessment and Preliminary Engineering Support Services (PES) Commissions

6.5.2 In 2011, the Cabinet Secretary announced full dualling of the A9 between Perth and Inverness by 2025. In response, in September 2012, Transport Scotland commissioned the SEA and PES studies for the dualling of the A9 between Perth and Inverness, carried out from 2012 to 2014, to examine the engineering and environmental aspects of the A9 Dualling Programme from Perth to Inverness. The commissions delivered a route wide assessment, identifying and collating environmental and engineering constraints, issues, risks and opportunities to inform better more detailed design.

6.5.3 Taken together these have provided an assessment equivalent to a DMRB Stage 1 assessment. The key reports from this strategic work are as follows and are available on the Transport Scotland website:

- DMRB Stage 1 Assessment - A9 Dualling: Preliminary Engineering Support Services (Transport Scotland, 2014a);
- A9 SEA - Environmental Report (Transport Scotland, 2013);
- A9 SEA - Addendum to the Environmental Report (Transport Scotland, 2014b); and
- A9 SEA - Post Adoption Statement (Transport Scotland, 2014c):
  - Appendix A - Consultation Response Tables.
  - Appendix B - Monitoring Framework Design Section Constraints Tables (not provided for the Pass of Birnam to Tay Crossing section).

6.5.4 The PES and SEA considered three high-level, strategic alternative dualling options:

- online widening - dualling along the existing A9 single carriageway sections, to tie in with the existing dualled sections;
- online widening with some near offline dualling - dualling along the existing A9 route, with near offline dualling where constraints dictated; and
- alternative route(s) - dualling via alternative routes to the existing A9.

6.5.5 As the Scottish Government's 2011 IIP committed to A9 dualling, consideration of a 'do nothing' option was not progressed.

6.5.6 The A9 Dualling: Preliminary Engineering Support Services report (Transport Scotland, 2014a) identified that online dualling, generally following the route of the existing A9, was the most suitable option. A 200m wide, online dualling corridor was identified for the environmental assessment (SEA), centred on the existing A9. However, it was noted that the 200m wide corridor represented a 'soft' boundary that could be extended locally, depending on constraints encountered at later design and environmental assessment stages.

6.5.7 The PES commission concluded that the proposed A9 dual carriageway will be a Category 7A all-purpose dual carriageway, in accordance with the DMRB at that time (Volume 6, Section 1, Part 1, TD 9/93: Highway Link Design). The standard requires that there will be no gaps in the central reserve and no at-grade minor junctions. It is also recommended that only grade separated junctions are provided on the route for safe access and egress to the A9. Isolated left-in left-out accesses may be provided in exceptional circumstances. Compact grade separated junctions and at-grade roundabouts should not be provided on Category 7A carriageways.

6.5.8 The PES commission developed a broad strategy for the treatment of existing junctions and accesses along the A9. The strategy states that A and B class roads that currently have direct access to the A9 will remain open, either through provision of a grade separated junction or realignment to connect to another junction, and that C class, unclassified, private and agricultural accesses will be closed unless suitable justification is provided.

6.5.9 In accordance with the A9 Junctions and Accesses Strategy, grade separated junctions should be provided at Birnam, where the A9 meets the B867 and Perth Road, Dunkeld, where the A9 has existing junctions with the A923 and A822, and Dalguise, where there is an existing junction with the B898.

6.5.10 Previous work, undertaken by AECOM, assessed alternative arrangements at Birnam where an underbridge connecting the B867 and Perth Road was provided, with no access to the dual carriageway. This was not taken forward due to the reduction in economic benefits associated with the arrangement and the negative feedback received from the public, primarily as a result of increased traffic on Perth Road. Similarly, at Dalguise, a restricted movement option removing the southbound diverge slip road was considered but not favoured following public consultation.

Drainage Development

6.5.11 Following the review of the A9 Dualling Programme DMRB Stage 1 Report (PES, Transport Scotland, 2014a) and SEA Reports (Transport Scotland 2013, 2014b, 2014c), there has been further development of the drainage design for this Project.

6.5.12 The primary objective of the drainage philosophy for the A9 is to provide efficient surface and sub-surface drainage solutions, which incorporate appropriately designed Sustainable Drainage System (SuDS) to reduce or negate the potential environmental impact of surface water runoff from the road on the water environment. The indicative choice of SuDS for Project 2: Pass of Birnam to Tay Crossing was also informed by an assessment of SuDS component suitability.

6.5.13 At DMRB Stage 2, the drainage design includes a range of indicative SuDS features intended to safeguard receiving water quality, avoid increased flood risk and, where possible, enhance amenity and natural habitats. The drainage design follows appropriate assessment criteria and relevant design guidance for the DMRB Stage 2 assessment. Consultation with the Scottish Environment Protection Agency (SEPA), Perth & Kinross Council and other interested parties has been considered in the drainage design to ensure compliance with environmental standards. The SuDS proposals would also be developed further as part of the ongoing design work undertaken at DMRB Stage 3.

6.6 AECOM Assessment (2012 to 2014)

6.6.1 Further assessment work was undertaken by AECOM to refine the previous options and take account of the route wide assessment, strategies and advice emerging from the SEA and PES commissions. This assessment developed an at-grade option, Option 6, which is a development of Option 1 from the original assessment, against a lowered alternative, Option 7. Option 6 removes the left-in left-out junction at Dunkeld & Birnam Station, with access to the station to the west of the railway tracks from the A822 via Dunkeld Junction. This option incorporated only a limited number of car parking spaces and no vehicular access to the station building. Access to the building is only via a pedestrian overbridge.

6.6.2 Option 7 was developed following public and stakeholder consultation in early 2012. This option involved lowering the A9 dual carriageway and a structure proposed over the A9 at existing ground level to link Station Road with the station. This option allows direct access to the station from Birnam and provides a parking facility on top of the structure.

6.6.3 Options 6 and 7, incorporated compact grade separated junctions, as defined in the DMRB at that time (Volume 6, Section 2, Part 5, TD 40/94: Layout of Compact Grade Separated Junctions), at Birnam, Dunkeld and Dalguise. Furthermore, the junctions proposed at Birnam and Dunkeld had junctions on the compact loops, which is not recommended by current standards and generates safety concerns. Options 6 and 7 incorporated a left-in left-out junction at the Hermitage.

6.6.4 Further details of the options are included in Volume 1, Part 1 - The Scheme. The assessment of the two options was not concluded and no recommendations were provided.

6.7 Jacobs Assessment (2014 to 2016)

6.7.1 In August 2014, Jacobs was awarded the commission to progress the Pass of Birnam to Tay Crossing section of A9 dualling. On appointment, Jacobs further considered Options 6 and 7, to address residual issues, which included:

- access to Dunkeld & Birnam Station for vehicular traffic (Option 6);
- consideration of the final outputs, strategies and conclusions of the SEA and PES commissions;
- landscape and visual impacts (Option 7); and
- constructability concerns within a constrained corridor (Option 7).

6.7.2 To address these issues, Jacobs undertook further assessment of options, which is detailed in the 'A9 Dualling Programme, Pass of Birnam to Tay Crossing, Stage 2 Preliminary Options Review Report (November 2016)'. This led to refinements to the previously considered options and the generation of an additional option for assessment.

6.7.3 The three options assessed by Jacobs; Options A, B and C, are summarised in Table 6.1. The options followed the same horizontal alignment and differed only in vertical alignment within the central section of the route, in the vicinity of Dunkeld & Birnam Station.

Table 6.1: DMRB Stage 2 Assessment Options Summary (Jacobs)

Scheme Options	Birnam Junction	Dunkeld Junction	Dalguise Junction
A	Grade separated junction, northbound and southbound loops. Connection of the B867 and Perth Road, crossing the A9 on an underbridge.	Grade separated junction, variation of diamond layout. Connection of the A822 and A923, crossing the A9 on an underbridge. Connection to Inver and northbound and southbound merge and diverge slip roads.	Grade separated junction with roundabout on the east of the A9, connected to the B898, crossing the A9 via an underbridge. Northbound loop with merge and diverge southbound slip roads.
B	Grade separated junction, northbound and southbound loops. Connection of the B867 and Perth Road, crossing the A9 on an underbridge.	Grade separated junction, variation of diamond layout. Connection of the A822 and A923, crossing the A9 on an overbridge. Connection to Inver and northbound and southbound merge and diverge slip roads.	Grade separated junction with roundabout on the east of the A9, connected to the B898, crossing the A9 via an underbridge. Northbound loop arrangement with merge and diverge southbound slip roads.
C	Grade separated junction, northbound and southbound loops. Connection of the B867 and Perth Road, crossing the A9 on an underbridge.	Grade separated junction, variation of diamond layout. Connection of the A822 and A923, crossing the A9 on an underbridge. Connection to Inver and northbound and southbound merge and diverge slip roads.	Grade separated junction with roundabout on the east of the A9, connected to the B898, crossing the A9 via an underbridge. Northbound loop arrangement with merge and diverge southbound slip roads.

6.7.4 To address accessibility issues with Dunkeld & Birnam Station within a narrow corridor, Options A and C proposed to relocate the station north of the Inchewan Burn, with access provided via the A822 to the west of the Highland Main Line railway.

6.7.5 For Option B, the A9 would be approximately 8 metres below existing ground level in the vicinity of Dunkeld & Birnam Station and a 150-metre-long structure was proposed over the A9. This arrangement allows Station Road to be extended across the structure providing direct access from the communities of Birnam, Little Dunkeld and Dunkeld to the station. A replacement car park would be provided on the structure. Options A, B and C incorporated a left-in left-out junction at The Hermitage.

6.8 A9 Co-Creative Process (2016 to 2018)

6.8.1 The three options considered by Jacobs, Options A, B and C, were presented to the public at an exhibition in January 2016 and discussed at a public meeting in February 2016. Feedback was requested from the community and concerns were raised as to the scale of the proposals, particularly the grade separated junction layouts. Dunkeld & Birnam Community Council requested more detailed consultation be undertaken with the local community to review the options and investigate if other suitable alternative options, that address community concerns, were available. As a result, Transport Scotland agreed to a co-creative process. Significant planning for the process was undertaken throughout 2016 and 2017, which involved appointing PAS (formerly Planning Aid Scotland), to facilitate the process. The Birnam to Ballinluig A9 Community Group was formed to represent the community during the A9 Co-Creative Process.

6.8.2 Following a series of community workshops in October and November 2017, the Birnam to Ballinluig A9 Community Group generated community objectives. The community's objectives are detailed below and have been mapped against the DMRB Stage 2 route options in *Appendix A7.1 (Mapping of Community Objectives Against DMRB Stage 2 Route Options).*

- Reduce current levels of noise and pollution in the villages of Dunkeld, Birnam and Inver to protect human health and well-being of residents and visitors and to enable them to peacefully enjoy their properties and amenity spaces.
- Protect and enhance the scenic beauty and natural heritage of the area and its distinctive character and quality.
- Provide better, safer access on and off the A9 from both sides of the road while ensuring easy, safe movement of vehicular traffic and NMUs[2] through the villages, helping to reduce stress and anxiety and support the local community.
- Promote long-term and sustainable economic growth within Dunkeld and Birnam and the surrounding communities.
- Examine and identify opportunities to enhance the levels of cycling and walking for transport and leisure, including the improvement of existing footpaths and cycle ways, to promote positive mental health and well-being.
- Ensure that all local bus, intercity bus services and train services are maintained and improved.
- Preserve and enhance the integrity of the unique and rich historical and cultural features of the Dunkeld, Birnam and Inver communities, thereby supporting well-being and the local economy.

6.8.3 The A9 Co-Creative Process consisted of five stages, beginning in January 2018 and concluding in June 2018. At Stage 1 of the process, the community was invited to submit ideas for A9 dualling. A total of 167 submissions were received, which included a wide range of ideas and options. At Stage 2 of the process, ideas were divided into constituent parts for assessment (i.e. Mainline Online, Mainline Offline, Murthly/Birnam Junction, Dunkeld Junction, Dalguise Junction, Dunkeld & Birnam Station and The Hermitage). Options that were single carriageway or that which were deemed unsafe, based on the level of assessment undertaken, were eliminated. Stages 4 and 5 included a public vote to determine the Community's Preferred Route Option (CPRO).

6.8.4 The outcome of the community voting was the CPRO, which obtained 37% of the vote. The CPRO is included in this DMRB Stage 2 assessment (Option ST2A). The commitment from the A9 Co-Creative Process is that the CPRO would be presented to Scottish Ministers for consideration.

6.8.5 For clarity, the CPRO is summarised below.

Community's Preferred Route Option

- Online route, largely following the alignment of the existing A9 single carriageway.
- A9 dual carriageway lowered into a cut and cover tunnel for approximately 1.5 kilometres, commencing at the southern extent in the vicinity of the existing Birnam Junction and terminating at its northern extent approximately 300 metres south of the existing Dunkeld Junction.
- Dunkeld & Birnam Station retained in its current position with Station Road re-connected to the station with replacement car parking provision on the structure.
- Speed limit of 50 miles per hour proposed between the southern extent of the scheme and proposed Dunkeld Junction. 70 miles per hour speed limit for the remainder of the scheme.
- Murthly/Birnam Junction:
  - grade separated junction in the locality of the existing private access to Murthly Castle;

[2] These objectives were developed when NMU was the terminology used in the DMRB. In this DRMB Stage 2 report, the term walkers, cyclists and horse-riders (WCH) is more commonly used to describe this group as it is the term used in the revised DMRB guidance.

- diamond layout, facilitating all vehicle movements, with northbound and southbound merge and diverge slip roads. An overbridge is provided across the A9 linking to the B867; and
- requires a connection of the B867 and Perth Road in the locality of the existing Birnam Junction, crossing the A9 at the southern extent of the cut and cover tunnel.

- Dunkeld Junction:
  - at-grade roundabout in the vicinity of the existing junction at Dunkeld, including a segregated left-lane between the A923 and A9 south; and
  - provides connections to the A9 (north and south), A923, A822 and road to Inver.
- The Hermitage:
  - left-in left-out junction on the northbound carriageway.
- Dalguise Junction:
  - grade separated junction south of the existing junction with the B898;
  - loops in the northbound direction and slip roads in the southbound direction, facilitating all vehicle movements; and
  - realigned B898 crosses the A9 on an underbridge, connecting to a roundabout on the east of the A9, which also connects to the southbound slip roads.

6.8.6 As part of the A9 Co-Creative Process, a number of ideas submitted were either non-spatial or out of scope of the A9 Dualling Programme. In total 37 non-spatial ideas were submitted and 40 out of scope ideas. A number of the non-spatial ideas would automatically be considered in later stages of the scheme development. Other non-spatial ideas, which are important to the community, would be retained and considered as appropriate in later stages of the scheme development, subject to programme, budget, deliverability and other constraints. A list of the non-spatial ideas submitted is included in Volume 1, Part 1 - The Scheme, Table 1.14 (A9 Co-Creative Process Non-Spatial Ideas).

6.9 Jacobs Assessment (2018 to 2020)

Identification of Additional Options

6.9.1 Since completion of the A9 Co-Creative Process, further work has been undertaken on the CPRO. This work considered the environmental, engineering and traffic impacts of the CPRO and included consultation with key stakeholders and residents in close proximity to the A9. This identified a number of challenges associated with the CPRO. As such, and as good practice dictates that a range of options should be considered, additional options for each constituent section of the scheme were identified, considered and comparatively assessed.

6.9.2 All constituent additional options were identified as viable options by the public as part of the A9 Co-Creative Process. The options for each constituent section were presented to the public in March 2019 and are summarised in Table 6.2.

Table 6.2: Additional Options

Additional Option	Description
Murthly/Birnam Junction	
Murthly/Birnam Additional Option 1	▪ Grade separated junction in the vicinity of the existing Birnam Junction; ▪ Merge/diverge loops in the northbound direction and a merge slip road in the southbound direction, with no southbound diverge slip road; ▪ B867 and Perth Road connected, crossing the A9 via an underbridge; and ▪ Includes an underbridge to connect the existing private access to Murthly Castle to the B867.
Murthly/Birnam Additional Option 2	▪ Grade separated junction in the vicinity of the existing Birnam Junction; ▪ Merge/diverge loops in the northbound and southbound directions, facilitating all vehicle movements; ▪ B867 and Perth Road connected, crossing the A9 via an underbridge; and ▪ Includes an underbridge to connect the existing private access to Murthly Castle to the B867.
A9 Dual Carriageway	
A9 Dual Carriageway Additional Option 1	▪ A9 dual carriageway lowered into a 150-metre-long underpass structure in the vicinity of Dunkeld & Birnam Station. Generally at-grade outwith this section; ▪ Largely following the horizontal alignment of the existing A9; ▪ Reconnection of Station Road to Dunkeld & Birnam Station; ▪ Replacement car park facility provided on top of the structure; ▪ Speed limit of 70mph throughout; and ▪ Inchewan Burn lowered by approximately 6 metres to accommodate the A9 dual carriageway.
A9 Dual Carriageway Additional Option 2	▪ A9 dual carriageway largely following the horizontal and vertical alignment of the existing A9; and ▪ Speed limit of 70mph throughout.
Dunkeld & Birnam Station	
Dunkeld & Birnam Station Additional Option 1	▪ Relocated station to the north, to an area of land immediately north of Inchewan Burn; ▪ Extension of existing rail passing loop to the north to accommodate the relocated station, which would require signalling works; ▪ Provision of new platforms and associated station infrastructure, including shelters; ▪ Vehicular access to the station from the A822, immediately west of the current railway underbridge, which would be the tie-in point for the works associated with Dunkeld Junction; ▪ Replacement car parking facility, which would include approximately fifty spaces, incorporating an appropriate number of accessible spaces, a vehicle pick-up drop-off and potentially provision for a bus stop and bus turning; ▪ Relocated station would include a pedestrian footbridge, incorporating either lifts or ramps to allow access between platforms; ▪ Walking, cycling and horse-riding (WCH) access maintained from Birnam Glen with a new structure constructed across Inchewan Burn; ▪ Suitable footpaths, in accordance with current relevant accessibility and disability legislation, would link to the platforms and station facilities; and ▪ No public vehicular access direct to the existing station platforms and Category A Listed building. A left-in left-out junction would be provided for Network Rail maintenance personnel only.

Additional Option	Description
Dunkeld & Birnam Station Additional Option 2	▪ Existing Dunkeld & Birnam Station maintained in its current position; ▪ Birnam Industrial Estate acquired, and the land utilised to construct a replacement station car park facility, which would include car parking provision for approximately fifty spaces, a vehicle pick-up drop-off point and potentially provision for a bus stop. The replacement car park would be accessed from Station Road; ▪ Current arrangements for access to the station via Birnam Glen, utilising stairs, would remain; ▪ A new pedestrian underpass structure constructed below the proposed A9 dual carriageway, linking the replacement car park with Platform 1 (southbound) of the station; ▪ The underpass structure would incorporate lifts and stairs to facilitate WCH access from the underpass level to the station; ▪ No works proposed to the existing station infrastructure, including platforms, pedestrian overbridge and track; and ▪ No public vehicular access direct to the existing station platforms and Category A Listed building. A left-in left-out junction would be provided for Network Rail maintenance personnel only.
Dunkeld Junction	
Dunkeld Junction Additional Option 1	▪ Grade separated junction, variation of diamond layout; ▪ All vehicle movements facilitated; ▪ Connection of the A822 and A923, crossing the A9 on an underbridge structure; ▪ Priority junction connecting the road to Inver with the realigned A822/A923; ▪ Northbound slip roads, incorporating taper merge and diverge. Northbound diverge slip road linking to the realigned A822/A923. Northbound merge slip road linking to the road to Inver; and ▪ Southbound slip roads, incorporating taper merge and diverge, linking to the realigned A822/A923.

6.9.3 Assessment identified a left-in left-out junction on the northbound carriageway at The Hermitage was the most suitable solution. As part of the A9 Co-Creative Process, a northbound left-in left-out junction was voted as the preferred option at this location by the public. As the assessment and the local community's preference is consistent, additional junction options at The Hermitage were not investigated.

6.9.4 Similarly, at Dalguise Junction, assessment identified a grade separated junction, with a roundabout on the east of the A9 connected to the B898 via an underbridge, with a northbound loop arrangement and merge and diverge southbound slip roads. As part of the A9 Co-Creative Process, the local community identified this option as their preference for Dalguise Junction. As such, additional options were not considered.

Initial Options Assessment

6.9.5 Alongside the CPRO (lowered A9 with re-connection of Station Road) two additional options were considered for Dunkeld & Birnam Station, as noted in Table 6.2. These additional options could only be used with an at-grade A9 dual carriageway. The comparative assessment concluded that the relocated Dunkeld & Birnam Station option should be removed from further consideration and not included in the whole route options. The reasons for this are as follows:

- does not meet a key principle from the A9 Co-Creative Process to re-connect Station Road to the station;

- involves works to track, signalling and platforms, that would impact the operation of the Highland Main Line railway, adding to the scheme complexity;
- adverse impact on the Category A Listed station building, which may impact the future viability of the building;
- greater changes to the landscape character, impacting the visual amenity for residents of Telford Gardens and Stell Park Road; and
- impact on Ladywell Landfill site, with potential to encounter contaminated soils and groundwater.

6.9.6 The level of assessment undertaken in the initial options assessment work was unable to eliminate any other options, including the additional options under consideration for the Murthly/Birnam Junction. Therefore, all other options were progressed for consideration at DMRB Stage 2.

6.9.7 Following stakeholder feedback and further consideration, the additional options presented to the community in March 2019 were developed into a number of Additional Whole Route Options. These Additional Whole Route Options were presented at a community drop-in event in May 2019 and are the subject of this DMRB Stage 2 assessment. The proposed route options for this DMRB Stage 2 assessment are fully described in Volume 1, Part 2 - Engineering Assessment and in Volume 1, Part 3 - Environmental Assessment (Chapter 7: Overview of Environmental Assessment).

Revisions to DMRB

6.9.8 Within the 2018 to 2020 assessment period, the DMRB Stage 2 assessment was undertaken using the DMRB guidance that was available at the time which was DMRB Volume 11 - Environmental Assessment (Highways Agency et al., 2009). In late 2019 and early 2020, the DMRB was revised, and the assessment updated to align with the revised DMRB 'Environment and Sustainability' guidance (Highways England et al., 2020).

6.10 References

Reports and Documents

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7. Overview of Environmental Assessment

7.1 Introduction

7.1.1 This chapter outlines the general approach followed for this Design Manual for Roads and Bridges (DMRB) Stage 2 environmental assessment of the proposed route options in relation to dualling of the A9 between the Pass of Birnam and Tay Crossing. In addition, this chapter explains the consultation process undertaken at DMRB Stage 2, how it has been used to inform the assessment and sets out the scope proposed for consultation to be taken forward into DMRB Stage 3 (refer to Section 7.6). This assessment has been undertaken in accordance with DMRB and other relevant guidance, legislation, and planning policy extant in July 2022. In addition, environmental baseline information used in the assessment reflects the known baseline in July 2022 for each of the environmental factors assessed. More detail on the methodologies and guidance used in relation to each individual environmental discipline are provided in the respective chapters.

7.1.2 Detailed descriptions of the route options can be found in Volume 1, Part 1 - The Scheme of this DMRB Stage 2 Scheme Assessment Report with a summary provided in this chapter. In addition, Volume 1, Part 3 - Environmental Assessment (Chapter 6: Summary of Previous Environmental Assessment) provides background on the process that has led to the route options that are assessed in this DMRB Stage 2 Scheme Assessment Report.

DMRB Environmental Assessment

7.1.3 The DMRB sets out UK wide guidance on the development of trunk road schemes. The DMRB specifically provides guidance on environmental assessment including Environmental Impact Assessment (EIA) and describes the level of assessment required at each of the key stages of development of a trunk road scheme. The DMRB guidance includes specific requirements for reporting environmental effects at each of the key stages.

7.1.4 Table 7.1 summarises the stages of DMRB assessment, as set out in DMRB TD 37/93[1] (The Highways Agency et. al., 1993a). For the A9 dualling projects, assessment equivalent to or greater than DMRB Stage 1 was achieved through completion of the DMRB Stage 1 Assessment: Preliminary Engineering Support Services (Transport Scotland, 2014a) and the Strategic Environmental Assessment (SEA) (Transport Scotland, 2013, 2014b, 2014c). DMRB Stage 2 (i.e. the current stage of scheme development) relates to comparative assessment of potential route options to inform the identification of the Preferred Route Option to be taken into DMRB Stage 3 and subject to an EIA.

Table 7.1: DMRB Assessment Stages

Stage	Stated DMRB Objective
Stage 1	Identify the environmental, engineering, economic and traffic advantages, disadvantages and constraints associated with broadly defined improvement strategies.
Stage 2	**Identify the factors to be taken into account in choosing alternative routes or improvement schemes and to identify the environmental, engineering, economic and traffic advantages, disadvantages and constraints associated with those routes or schemes.**
Stage 3	Identify clearly the advantages and disadvantages, in environmental, engineering, economic and traffic terms, of the Overseeing Department's preferred route or scheme option. A particular requirement at this stage is an assessment of the significant environmental effects of the project, in accordance with the requirements of the … Roads (Scotland) Act 1984 … implementing EC Directive 85/337.

Source: DMRB (Volume 5, Section 1, Part 2, TD 37/93, Chapter 2: Scheme Assessment Reporting)

[1] TD 37/93 'Scheme Assessment Reporting' and other associated documents remain current in Scotland, despite being withdrawn from DMRB.

7.1.5 The primary aim of DMRB Stage 2 assessment is to consider route options (which may vary for example by vertical or horizontal alignment or junction layout). Once the Preferred Route Option is selected through the DMRB Stage 2 process, the design is then further developed and assessed at DMRB Stage 3 and the Preferred Route Option is the subject of an EIA under the relevant legislation.

Design Refinement

7.1.6 The proposed route options assessed in this report have been developed to a level of detail appropriate to enable robust comparative assessment of the various alternative route options. It should be noted that these are therefore indicative designs, and the Preferred Route Option selected following completion of DMRB Stage 2 assessment would be subject to ongoing design development as part of the DMRB Stage 3 process, iteratively informed by environmental considerations.

7.2 Identification of Route Options

7.2.1 This section provides a general overview of the proposed route options, including DMRB Stage 2 assessment assumptions/understanding for design aspects such as drainage revision and earthworks. More detailed descriptions of the route options are provided in Section 7.3.

7.2.2 References are made to chainage (shortened to 'ch', for example ch1500), which is a locational reference to the number of metres from the start of the proposed route options, numbered from south to north.

Summary

7.2.3 Following the A9 Co-Creative Process, the Community's Preferred Route Option (CPRO) has been included within the DMRB Stage 2 assessment along with Additional Whole Route Options.

7.2.4 The combination of additional mainline and junction options gives the potential for nine additional route options. In order to reduce the number of additional route options in the DMRB Stage 2 assessment, the three junction options at Murthly and Birnam were comparatively assessed, taking into consideration the environmental, engineering and traffic impacts (refer to *Appendix A3.1 (Murthly/Birnam Assessment Report)*).

7.2.5 As a result of the DMRB Stage 2 level assessment undertaken on the three junction options at Murthly and Birnam (refer to *Appendix A3.1 (Murthly/Birnam Assessment Report)*), Additional Option 1, which is a restricted movement grade separated junction at Birnam, was identified as the preferred junction option. This has therefore been included in the proposed route options to be comparatively assessed with the CPRO in this DMRB Stage 2 Scheme Assessment Report. The other Murthly and Birnam junction options were removed from further consideration and are not assessed further in this DMRB Stage 2 Scheme Assessment Report.

7.2.6 The CPRO and the three proposed route options considered in this environmental assessment are shown on Figures 7.1 and 7.2 and include:

- Option ST2A (CPRO);
- Option ST2B;
- Option ST2C; and
- Option ST2D.

Mainline Route Alignments

7.2.7 The dual carriageway proposed for each of the proposed route options comprises two lanes in each direction, separated by a 2.5m central reserve (with widening for visibility where required), and 2.5m verges (also widened for visibility where required). Figure 7.1 shows the full alignment of Option ST2A and Option ST2B, Figure 7.2 shows the full alignment of Option ST2C and Option ST2D.

7.2.8 It should be noted that the four proposed route options being considered generally follow the same horizontal alignment. However, vertical alignments differ significantly from ch0-5000. Figure 7.3 illustrates the vertical alignment of each proposed route option from ch0-5000. From ch5000 both the vertical and horizontal alignments of all proposed route options are the same.

Junctions and Road Connections

Junctions

7.2.9 There are currently five existing at-grade side road junctions on the existing A9 within the Pass of Birnam and Tay Crossing section, each of which currently permit trunk road access and egress to the local road network in both directions, namely:

- left/right staggered priority junction with the B867 and Perth Road;
- priority junction to Dunkeld & Birnam Station;
- right/left staggered priority junction with the A923 and A822 (Old Military Road);
- priority junction to The Hermitage; and
- priority junction with the B898.

7.2.10 There are three main junctions proposed along the scheme. These are located at either Murthly (Option ST2A) or Birnam (Options ST2B, ST2C and ST2D) as well as Dunkeld and Dalguise. The Dunkeld Junction varies between proposed route options and the Dalguise Junction is the same for all proposed route options. The junction designs are explained in Section 7.3, and shown on Figures 7.4, 7.5 and 7.6.

7.2.11 A left-in left-out junction is also proposed for all route options on the northbound carriageway on the northbound carriageway to provide access for The Hermitage; a National Trust for Scotland protected site, which is an important tourist destination.

7.2.12 Option ST2C and Option ST2D have an additional left-in left-out junction on the northbound carriageway to provide maintenance and emergency access to the existing Dunkeld & Birnam Station. Access to Dunkeld & Birnam Station for all proposed route options would be provided via Station Road (refer to paragraphs 7.2.25 to 7.2.38).

Road Connections

7.2.13 There are currently 13 direct access points off the A9 serving a mixture of residential, agricultural and forestry activities. For safety reasons, existing direct accesses onto the A9 (e.g. access to land or property) would generally be stopped-up, with alternative provision anticipated to be provided as part of the development of the Preferred Route Option at DMRB Stage 3.

7.2.14 The engineering work undertaken to date has confirmed that it is technically feasible to re-connect and/or divert potentially directly affected minor accesses identified as Tier 2 (C-classified roads or unclassified roads) or Tier 3 (private or agricultural roads). These alternative access solutions are comparable across all proposed route options and would be assessed and developed in detail at DMRB Stage 3 alongside consultation with affected parties. This would include review of options to refine alignments, further consultation with statutory consultees and liaison with affected parties.

Lay-bys

7.2.15 There are currently no proposals to provide parking lay-bys within any of the proposed route options (refer to Volume 1, Part 2 - Engineering Assessment, Section 5.7 (Lay-by and Rest Areas)). Transport Scotland has developed an enhanced lay-by strategy for the full programme of A9 Dualling Programme projects. The intention is to provide a number of lay-bys/rest areas on the A9 between Perth and Inverness, as part of the DMRB Stage 3 Preferred Route Option designs, which would be located in areas of particular interest and provide improved connectivity to the surrounding environment. The SEA for the A9 Dualling Programme (Transport Scotland, 2013, 2014b, 2014c) has identified a number of potential locations for enhanced lay-bys within the Pass of Birnam to Tay Crossing project. Their inclusion in the design would be considered and assessed during the DMRB Stage 3 assessment.

Watercourse Crossings

7.2.16 The existing A9 between the Pass of Birnam and Tay Crossing crosses two major watercourses, the River Braan and the River Tay, which form part of the River Tay Special Area of Conservation (SAC). It also crosses one minor watercourse, Inchewan Burn. There are three existing river bridges carrying the A9:

- over the Inchewan Burn, which is alongside Birnam Glen, in close proximity to Dunkeld & Birnam Station as shown in Photograph 7.1;
- over the River Braan, to the immediate north of the current right/left staggered priority junction with the A822 (Old Military Road) and the A923 as shown in Photograph 7.2; and
- over the River Tay at the northern extent of the section as shown in Photograph 7.3 and Photograph 7.4.

Photograph 7.1: Crossing of Inchewan Burn at Birnam Glen – taken from the east bank of the burn adjacent to the northbound carriageway

Photograph 7.2: River Braan Crossing – taken from the foot bridge over the River Braan adjacent to the northbound carriageway of the existing A9

Photograph 7.3: Tay Crossing – taken from the south bank of the river adjacent to the southbound carriageway

Photograph 7.4: Tay Crossing – taken from the north bank of the river adjacent to the southbound carriageway

7.2.17 While further assessment would be undertaken as part of the DMRB Stage 3 assessment, initial structural solutions have been proposed, as detailed below:

- Inchewan Burn: a new A9 structure would be constructed for all proposed route options. For Option ST2A, vertical realignment of approximately 8m is required for the burn, to accommodate the proposed cut and cover tunnel which would comprise a drop structure and new box culvert. For Option ST2B, the new structure would be the same as Option ST2A but with a vertical realignment of approximately 6m. For Option ST2C and Option ST2D, the vertical alignment of Inchewan Burn would be unaffected.
- River Braan: a new A9 structure would be constructed for all proposed route options.
- River Tay: existing structure would carry the A9 northbound carriageway and a new structure would accommodate the southbound carriageway for all proposed route options.

7.2.18 These crossings are described further in Volume 1, Part 3 - Environmental Assessment (Chapter 10: Road Drainage and the Water Environment).

Drainage Design

7.2.19 Existing road drainage treatment on the single carriageway A9 between the Pass of Birnam and Tay Crossing is generally limited, consisting of kerbs and gullies which direct untreated road runoff to an outfall into the nearest water feature. In certain areas there are lengths of filter drain in the verges that provide initial (one Sustainable Drainage System (SuDS) level) treatment for some of the runoff from the road and/or adjacent earthworks slopes.

7.2.20 The design development work undertaken to date has confirmed that implementation of a new SuDS drainage system can be achieved, with due consideration of constraints such as topography and flood risk and would be able to achieve the necessary technical standards and satisfy the requirements of the Scottish Environment Protection Agency (SEPA) (generally two 'levels' of treatment). Indicative locations of SuDS basins are shown on the environmental figures and their locations are assessed in this report.

7.2.21 The drainage design would continue to be developed and assessed in detail as part of early work at DMRB Stage 3. This would include review of options to refine shape and position, type of treatment proposed, further consultation with statutory consultees, and liaison with any potentially affected landowners.

Earthworks

7.2.22 Dualling of the A9 would require earthworks slopes, either as cuttings (i.e. where road is lower than existing ground level) or embankments (i.e. where road is higher than existing ground level). Where the route already passes through sections of cuttings or embankments, these would generally require widening to accommodate the new carriageway.

7.2.23 The general objective of design development of slopes is that the adjoining landform is utilised as a template such that, wherever possible, new earthworks reflect nearby contours in terms of scale and variation. This would help to integrate the new road into the surrounding environment, improving its landscape fit. There may also be locations where existing cuttings or embankments created during construction of the existing A9 can be improved as part of the A9 dualling works.

7.2.24 There may be other constraints to slopes, such as proximity to floodplain, the surrounding road network, or properties alongside the A9. Gentler slopes result in the requirement for a greater area of land to be acquired through compulsory purchase, although in some instances, portions of this land can be returned to its previous use following completion of construction (e.g. as agricultural land). Cuttings and embankments may accommodate landscape planting developed as part of landscape/visual mitigation proposals at DMRB Stage 3. Steepened earthworks and retaining walls would be required at certain locations for some of the proposed route options and junction arrangements.

Dunkeld & Birnam Station

7.2.25 The DMRB Stage 2 assessment considers the potential impacts on Dunkeld & Birnam Station including the Category A Listed station building.

7.2.26 All proposed route options enable the station to be retained such that it can continue to operate in its current position. However, for all route options there would be change of access and a replacement station car park would be required which would be delivered as part of the proposed route options. For Options ST2A and ST2B, vehicular and pedestrian access would be via Station Road with parking provided on top of the cut and cover tunnel (Option ST2A) or underpass (Option ST2B). For Options ST2C and ST2D, direct vehicular access would be limited to maintenance and emergency vehicles. Private vehicle access would be via Station Road to a replacement car parking facility within the extent of Birnam Industrial Estate. This would be connected to the station via a new pedestrian underpass structure. This is discussed in further detail in Section 7.3 for each proposed route option.

7.2.27 In order to maintain access to Dunkeld & Birnam Station during construction, five access options have been considered. These are fully described in Volume 1, Part 2 - Engineering Assessment (paragraph 5.13.26), of this DMRB Stage 2 Scheme Assessment Report and summarised in the following paragraphs. All options could potentially be considered for Options ST2A and ST2B. For Options ST2C and ST2D, access option 2 would be the most likely to be used.

<u>Access option 1: Extension of both Platforms (including vehicular access to Platform 2)</u>

7.2.28 Access option 1 includes the extension of both railway platforms to the north of Inchewan Burn. A new railway structure would be required over Inchewan Burn to link the proposed new platforms to existing platforms and the pedestrian footbridge which forms part of the Dunkeld and Birnam Station including Footbridge, Category A Listed Building (Asset 26, *Appendix A14.1: Cultural Heritage Assets Gazetteer*). This would require replacing the existing masonry arch structure which is within the Birnam Conservation Area.

7.2.29 Public vehicular access would be via the new access road from the A822 (Old Military Road) which forms part of the proposed design for Options ST2A and ST2B. A replacement car parking facility would be required immediately west of the Highland Main Line railway, accessed from the new access road from the A822 (Old Military Road). Footpaths linking the proposed car parking facility to the extended platforms would be constructed in accordance with relevant accessibility and disability legislation.

7.2.30 There would be no public vehicular access direct to the existing Category A Listed station building or Platform 1 (southbound) and no suitable walkers, cyclists or horse-riders (WCH) access direct from Birnam and Dunkeld or the A822 (Old Military Road).

Access option 2: Temporary Pedestrian Footbridge to Platform 1

7.2.31 Access option 2 includes a temporary pedestrian footbridge which would provide direct access from Birnam Industrial Estate to the station (Platform 1, southbound). This temporary footbridge would likely incorporate lifts to improve accessibility.

7.2.32 Under this option there would be no works to the existing station infrastructure, including platforms, pedestrian footbridge and track and there would be no public vehicular access direct to the existing Category A Listed station building during construction. Instead, limited temporary car parking would be provided within the extent of Birnam Industrial Estate.

Access option 3: Extension of both Platforms (including vehicular access to Platform 2) and Temporary Pedestrian Footbridge to Platform 1 from Birnam Industrial Estate.

7.2.33 Access option 3 is a combination of access option 1 (paragraphs 7.2.28 to 7.2.30) and access option 2 (paragraphs 7.2.31 and 7.2.32).

Access option 4: Temporary Pedestrian Footbridge over Inchewan Burn linking existing Platform 2 to temporary parking off the new access road to the A822 (Old Military Road).

7.2.34 Access option 4 includes a temporary pedestrian footbridge over Inchewan Burn which would provide access to the station (Platform 2, northbound) from a temporary car park facility to the north of Inchewan Burn. Public vehicular access would be via the new access road from the A822 (Old Military Road). There would be no public vehicular access direct to the existing Category A Listed station building or Platform 1 (southbound).

7.2.35 Under this option there would be no works to the existing station infrastructure, including platforms, pedestrian footbridge and track and there would be no public vehicular access direct to the existing Category A Listed station building during construction of Options ST2A and ST2B. There would be no suitable WCH access direct from Birnam and Dunkeld or the A822 (Old Military Road).

Access option 5: Temporary pedestrian footbridge across the A9 construction site, from Birnam Industrial Estate to Dunkeld & Birnam Station, Platform 1 (southbound) and a temporary pedestrian footbridge across Inchewan Burn, linking the existing Platform 2 (northbound) and the new access road from the A822 (Old Military Road).

7.2.36 Access option 5 is a combination of access option 2 (paragraphs 7.2.31 and 7.2.32) and access option 4 (paragraphs 7.2.34 and 7.2.35).

7.3 Proposed Route Options

Option Description

7.3.1 The proposed route options are shown on Figure 7.1 (Option ST2A and Option ST2B) and Figure 7.2 (Option ST2C and Option ST2D). Figure 7.3 shows the vertical alignment of all four proposed route options. Figure 7.4 shows the Murthly and Birnam Junctions in more detail and Figures 7.5 and 7.6 show Dunkeld and Dalguise Junctions, respectively.

7.3.2 The Pass of Birnam to Tay Crossing section of the A9 Dualling Programme begins at its southern extent at the end of the existing dual carriageway section of the A9 through the Pass of Birnam, approximately 15 km from Inveralmond Roundabout in Perth. Each proposed route option differs between ch0 to ch5000 and a description of each is provided below.

Option ST2A

ch0-2150

7.3.3 The first junction of the proposed route option, Murthly Junction (Illustration 7.1 and Figure 7.4a), is located immediately north of the southern tie-in point at the existing minor private access to Murthly Estate. The proposed junction is a grade separated diamond layout, with merge and diverge slip roads in the northbound and southbound directions, facilitating all vehicle movements. An overbridge is provided across the A9, connecting to the B867 to the west via an at-grade junction. A connection to Murthly Estate is also included to the east.

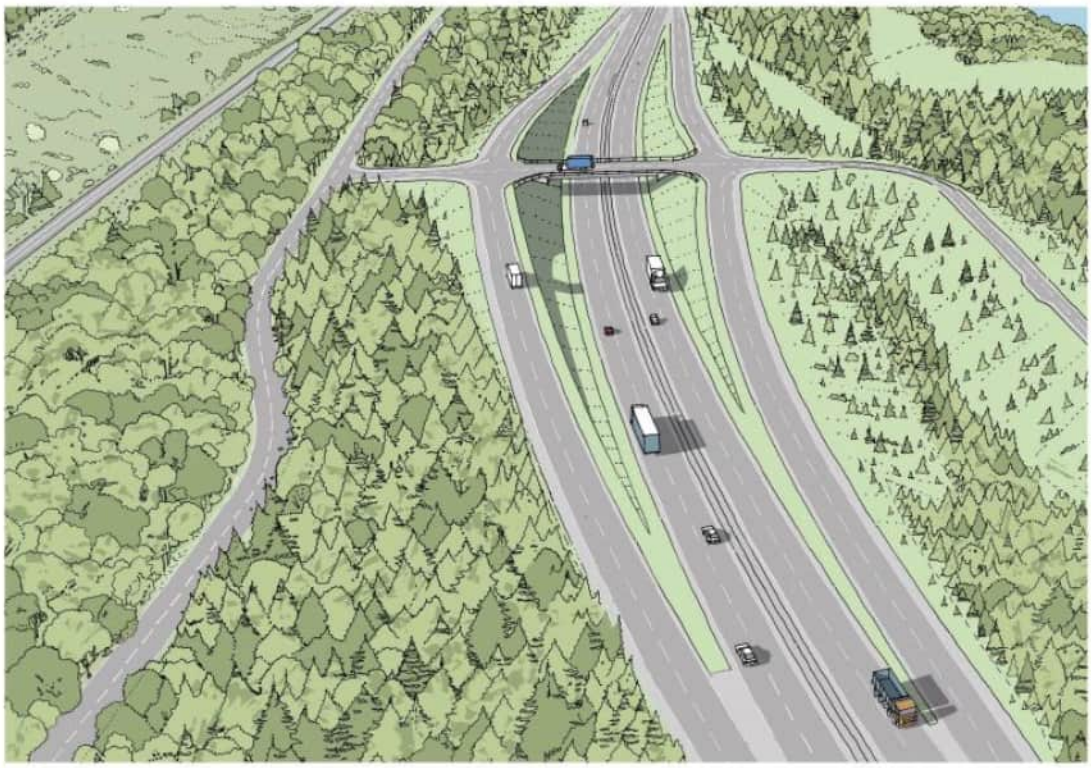

Illustration 7.1. An artist's impression of the proposed grade separated junction at Murthly

7.3.4 Option ST2A incorporates a cut and cover tunnel approximately 1.5km in length, therefore, the alignment begins to drop lower than existing ground levels and is in cutting as it approaches the tunnel's southern portal, which is in the vicinity of the existing left/right staggered priority junction with the B867 and Perth Road at Birnam (ch2150). The B867 and Perth Road are connected, crossing the A9 at existing ground level, immediately north of the southern tunnel portal. For details of tunnel construction, please refer to Volume 1, Part 2 - Engineering Assessment.

ch2150-4000

7.3.5 At the southern extent of the cut and cover tunnel (refer to Illustration 7.2) the alignment is constrained by the Highland Main Line railway to the immediate west and residential properties to the immediate east. The proposed A9 dual carriageway is generally around 10m below existing ground level with the top of the cut and cover tunnel at existing carriageway levels.

7.3.6 Continuing north, the alignment travels through a narrow corridor with the Highland Main Line railway and Dunkeld & Birnam Station immediately adjacent to the west and residential properties on Gladstone Terrace and Station Cottages to the east. Widening through this section is to the west, towards Dunkeld & Birnam Station, directly affecting the existing railway sidings (with opportunity to reinstate post construction), station car park and encroaching closer to the station building. Option ST2A allows Station Road to be extended across the cut and cover structure providing direct access from Birnam and Dunkeld to the station. A replacement car park and vehicle turning provision is provided on top of the cut and cover tunnel (refer to Illustration 7.3).

Illustration 7.2 An artist's impression of the proposed southern portal of the cut and cover tunnel

Illustration 7.3 An artist's impression of the proposed main alignment in a cut and cover as it passes Dunkeld & Birnam Station

7.3.7 As the A9 is lowered in the vicinity of the station, Birnam Glen would be stopped-up at the location of the current A9 underbridge, immediately north of Dunkeld & Birnam Station. Access to properties on Birnam Glen to the west of the station would be provided via a new access road from the A822 (Old Military Road) that would be to the west of the Highland Main Line railway. A new underbridge structure is included to cross Inchewan Burn. Inchewan Burn itself would be lowered by approximately 8m as a result of the cut and cover tunnel, crossing the A9 via a new drop structure and culvert.

7.3.8 To the north of the Inchewan Burn the road alignment transitions to a straight on approach to Dunkeld Junction, near the existing right/left staggered priority junction with the A923 and A822 (Old Military Road) at Little Dunkeld (ch4000). The alignment continues to be constrained by the Highland Main Line railway and residential properties, which are generally higher than existing carriageway levels. The northern portal of the cut and over tunnel is at ch3730, approximately 300m south of the proposed Dunkeld Junction. Beyond the northern portal of the cut and cover tunnel, the vertical alignment returns to existing ground level to tie-in to the Dunkeld Junction.

ch4000-5000

7.3.9 Dunkeld Junction (refer to Illustration 7.4 and Figure 7.5a) is located at the site of the existing right/left staggered priority junction with the A923 and A822 (Old Military Road) at Little Dunkeld. Dunkeld Junction is an at-grade elongated roundabout that provides connections to the A9 (north and south), A923, A822 (Old Military Road) and the unclassified road to Inver. A segregated left lane is included between the A923 and A9 south to improve the overall capacity of the roundabout and to reduce queuing traffic.

Illustration 7.4 An artist's impression of the proposed at-grade roundabout at Dunkeld Junction

7.3.10 The proposed alignment crosses the River Braan on a wider structure, to accommodate the dual carriageway, and is approximately 3m higher than existing ground levels to ensure the A9 is not impacted by anticipated future flood levels.

Option ST2B

ch0-2500

7.3.11 The vertical alignment is generally at-grade with widening on the northbound side. The existing private access to Murthly Estate, located on the existing southbound carriageway is stopped-up and a new underbridge constructed, which links to the B867 to the west.

7.3.12 The alignment transitions to a straight and is slightly offline to the west to improve the alignment on approach to Birnam Junction (Figure 7.4a), with cutting slopes introduced on the northbound carriageway. Birnam Junction is located at the site of the existing left/right staggered priority junction with the B867 and Perth Road at Birnam. The proposed junction is a grade separated layout, incorporating loops with merge and diverge tapers in the northbound direction and a merge slip road in the southbound direction (refer to Illustration 7.5). The junction does not include a southbound diverge slip road. The B867 and Perth Road are connected and realigned, crossing the A9 on an underbridge structure.

Illustration 7.5 An artist's impression of the Birnam Junction

ch2500-5000

7.3.13 North of Birnam Junction, the alignment is constrained by the Highland Main Line railway to the immediate west and residential properties to the immediate east. Vertically, the A9 alignment begins to lower as it navigates the right-hand horizontal curve. Widening through this section is to the west, directly affecting the existing railway sidings (with limited opportunity to reinstate post construction), the Dunkeld & Birnam Station car park and encroaching closer to the station building. The dualling of the A9 at the station is approximately 8m below ground level and a 150m long underpass structure is proposed over the A9 at-grade. To support the structure and avoid encroachment towards the Highland Main Line railway and station building to the west and residential and commercial properties to the east, large diameter bored piled walls would be required in both verges and the central reserve of the A9. This arrangement allows Station Road to be extended across the structure providing direct access from the communities of Birnam and Dunkeld to the station. A replacement car park with vehicle turning provision is provided on top of the structure (Illustration 7.6).

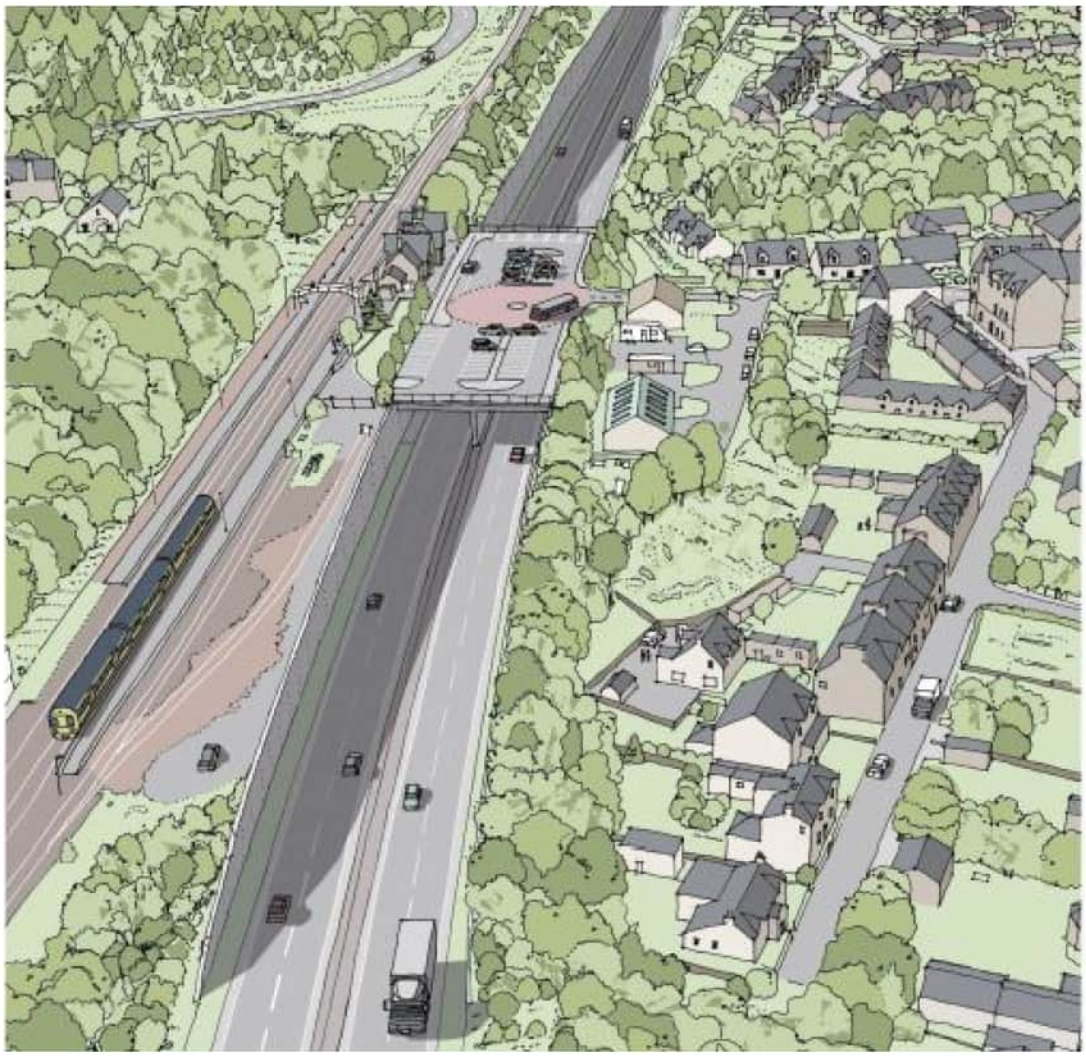

Illustration 7.6 An artist's impression of the underpass and replacement station car park at Dunkeld & Birnam Station

7.3.14 As the A9 is lowered in the vicinity of the station, Birnam Glen would be stopped-up at the location of the existing A9 underbridge, immediately north of Dunkeld & Birnam Station. Access to properties on Birnam Glen to the west of the station would be provided via a new access road from the A822 (Old Military Road) that would be to the west of the Highland Main Line railway. A new underbridge structure is included to cross Inchewan Burn. Inchewan Burn itself would be lowered by approximately 6m as a result of lowering the road alignment. Inchewan Burn would cross the dualled A9 via a new drop structure and box culvert.

7.3.15 To the north of the Inchewan Burn crossing, the horizontal alignment transitions to a straight on approach to Dunkeld Junction (Illustration 7.4 and Figure 7.5a), which is in the vicinity of the existing right/left staggered priority junction with the A923 and A822 (Old Military Road) at Little Dunkeld (ch4000). In this location, the alignment continues to be constrained by the Highland Main Line railway and residential properties, which are generally higher than existing carriageway levels. Beyond the underpass structure, the vertical alignment returns to existing ground levels to tie-in to Dunkeld Junction. Dunkeld Junction is an at-grade elongated roundabout that provides connections to the A9 (north and south), A923, A822 (Old Military Road) and the unclassified road to Inver. A segregated left lane is included between the A923 and A9 south to improve the overall capacity of the roundabout and to reduce queuing traffic.

7.3.16 To the north of the roundabout, Option ST2B crosses the River Braan on a wider structure, to accommodate the dual carriageway, and is approximately 3m higher than existing ground levels to ensure the A9 is not impacted by anticipated future flood levels.

Option ST2C

7.3.17 Between ch0-2500, Option ST2C is the same as Option ST2B (paragraphs 7.3.11 and 7.3.12).

Ch2500 to Ch5000

7.3.18 North of Birnam Junction, Option ST2C follows the same horizontal alignment as Option ST2B and is generally at-grade in the vicinity of Dunkeld & Birnam Station and directly affects the existing railway sidings (with no opportunity to reinstate in this location post construction), the Dunkeld & Birnam Station car park and encroaches closer to the station building. Immediately north of the station, the A9 crosses Birnam Glen and Inchewan Burn on an overbridge as it transitions into a right-hand horizontal curve and begins to rise from existing ground levels to negotiate the proposed Dunkeld Junction. The south facing slip roads of Dunkeld Junction begin immediately north of the underbridge structure.

7.3.19 Option ST2C incorporates a replacement car parking facility, to replace those lost at Dunkeld & Birnam Station as a result of A9 dualling, within the extent of Birnam Industrial Estate on Station Road (Illustration 7.7). A pedestrian underpass structure below the A9, connecting the car park to the station is included, as well as lifts and/or ramps to provide access to platform level.

7.3.20 The existing access to properties on Birnam Glen to the west of Dunkeld & Birnam Station would remain and Inchewan Burn would not be directly affected. A left-in left-out junction on the northbound carriageway is proposed in the vicinity of Dunkeld & Birnam Station to provide maintenance and emergency access. No public vehicular access would be available.

7.3.21 The alignment continues to be constrained through this section by the Highland Main Line railway, parallel to the west, and residential properties of Stell Park Road, Telford Gardens and King Duncan's Place to the east. As the A9 is elevated through this section the carriageway is at a similar level to that of the adjacent railway and properties. Small sections of low height retaining walls are necessary alongside residential properties to prevent encroachment.

7.3.22 Dunkeld Junction (Illustration 7.8) is located at the site of the existing right/left staggered priority junction with the A923 and A822 (Old Military Road). The junction is a variation of a diamond layout, which connects the A822 (Old Military Road) and the A923, crossing the A9 via an underbridge structure. Northbound and southbound slip roads facilitate all vehicle movements. A link to the unclassified road to Inver is also included.

Option ST2D

7.3.23 Between ch0-2500, Option ST2D is the same as Option ST2B (paragraphs 7.3.11 and 7.3.12) and Option ST2C.

ch2500-5000

7.3.24 North of Birnam Junction, Option ST2D follows the same horizontal alignment as Option ST2B and Option ST2C. Option ST2D is generally at-grade in the vicinity of Dunkeld & Birnam Station and remains at-grade until Dunkeld Junction (Figure 7.5b). As a result, the existing access to properties on Birnam Glen to the west of Dunkeld & Birnam Station is retained and there is no direct impact on Inchewan Burn. Widening through this section is also to the west, directly affecting the existing railway sidings (with no opportunity to reinstate in this location post construction), the station car park and encroaching closer to the station building.

7.3.25 Option ST2D incorporates a replacement car parking facility, to replace that lost at Dunkeld & Birnam Station as a result of A9 dualling, within the extent of Birnam Industrial Estate on Station Road (Illustration 7.7). A pedestrian underpass structure below the A9, connecting the car park to the station is included, as well as lifts and/or ramps to provide access to platform level.

7.3.26 The existing access to properties on Birnam Glen to the west of Dunkeld & Birnam Station would remain and Inchewan Burn would not be directly affected. A left-in left-out junction on the northbound carriageway is proposed in the vicinity of Dunkeld & Birnam Station to provide maintenance and emergency access. No public vehicular access would be available.

7.3.27 Dunkeld Junction is an at-grade elongated roundabout (Illustration 7.4) that provides connections to the A9 (north and south), A923, A822 (Old Military Road) and the unclassified road to Inver. A segregated left lane is included between the A923 and A9 south to improve the overall capacity of the roundabout and to reduce queuing traffic.

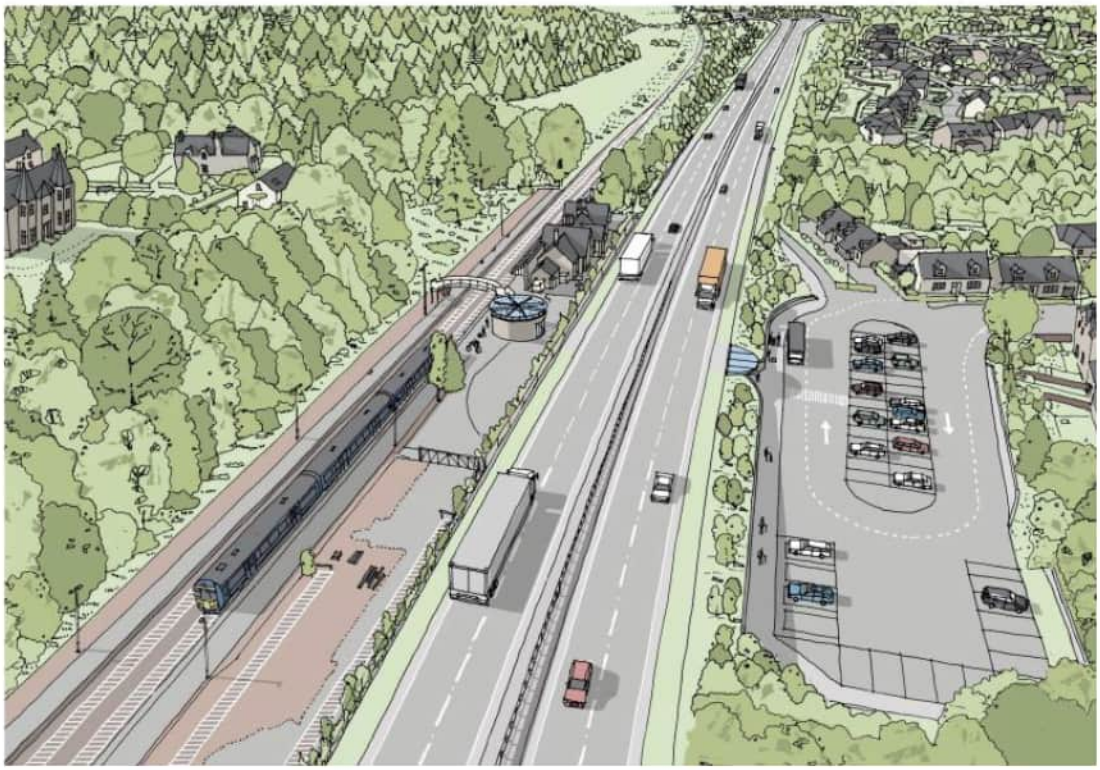

Illustration 7.7. An artist's impression showing an at-grade A9 carriageway and the replacement car parking facility at Birnam Industrial Estate

Illustration 7.8. An artist's impression showing a grade separated Dunkeld Junction

7.3.28 To the north of the roundabout, Option ST2D crosses the River Braan on a wider structure, to accommodate the dual carriageway, and is approximately 3m higher than existing ground levels to ensure the A9 is not impacted by anticipated future flood levels.

All Route Options (ch5000-8400 (end))

7.3.29 Beyond the River Braan crossing, the A9 passes Inver which is on the northbound side of the road. There is southbound widening at this location for all proposed route options, moving the A9 closer to the River Tay and impacting a residential property, Auchlou Cottage (which is under the ownership of Scottish Ministers).

7.3.30 A left-in left-out junction is proposed on the northbound carriageway immediately north of Inver for access to The Hermitage. In this location, the alignment is generally at-grade and on a straight. North of The Hermitage, there is a right-hand horizontal curve. At the start of the curve, the alignment crosses the Highland Main Line railway where the railway passes through the Inver Rail Tunnel. To accommodate the dual carriageway, the rail tunnel would be extended. The proposed alignment navigates a right-hand horizontal curve and is offline to the west. The topography of the existing ground results in sections of large cut slopes on the northbound carriageway.

7.3.31 The final junction, Dalguise Junction (Illustration 7.9 and Figure 7.6), is located south of the existing priority junction with the B898. The Dalguise Junction is grade separated, incorporating loops in the northbound direction and slip roads in the southbound direction, facilitating all vehicle movements. The realigned B898 crosses under the A9 via an underbridge, connecting to a roundabout on the east side of the A9, which also connects to the southbound exit and entry slip roads.

Illustration 7.9. An artist's impression showing Dalguise Junction

7.3.32 North of the Dalguise Junction underbridge, the A9 dual carriageway transitions to a straight and is generally at-grade as it crosses the Inch Rail Tunnel, which would be extended to the east, and the River Tay. A new structure would be constructed alongside the existing River Tay bridge to the east to accommodate the dual carriageway.

7.3.33 Immediately north of the River Tay crossing, the alignment is largely at-grade. Topography to the east results in significant earthwork cutting slopes on the southbound carriageway. Approximately 0.75km from the River Tay crossing is the tie-in point with the A9 Dualling: Tay Crossing to Ballinluig scheme (Project 03).

Constructability

7.3.34 The proposed route options under consideration involve significant construction works within a constrained corridor, potentially impacting environmentally sensitive sites as well as residential and commercial properties. Aspects of the design and assessment more commonly developed at later stages, would have potentially significant impacts and would influence the identification of the Preferred Route Option. As a result, key aspects of design have been assessed in greater detail as part of this DMRB Stage 2 assessment. For details of the design and engineering assessment, refer to Volume1, Part 2 - Engineering Assessment of this DMRB Stage 2 Scheme Assessment Report.

7.3.35 A summary is presented here to indicate constructability differences between the route options. The environmental impact of these different options is discussed in the relevant environmental chapters.

Option ST2A

7.3.36 Option ST2A includes construction of a 1.5km cut and cover tunnel. Insufficient space exists for an open excavation, therefore the walls that form part of the cut and cover tunnel would be constructed using large diameter bored piles. Installation would require heavy plant in close proximity to residential properties, Dunkeld & Birnam Station, the Highland Main Line railway and approximately 2.5m from the Category A Listed station building. Construction would generate noise and vibration, with the potential to affect residential properties in the vicinity of the works. Potential vibration impacts on the station building are presented in Volume 1, Part 3 - Environmental Assessment (Chapter 16: Noise and Vibration).

7.3.37 There is expected to be a potentially significant impact for those properties immediately adjacent to the cut and cover tunnel as bored piled walls are formed over a significant length, resulting in approximately 3,700 piles in total. The cut and cover tunnel also requires a widened cross-section to accommodate an emergency evacuation tunnel.

7.3.38 In order to construct the cut and cover tunnel, Inchewan Burn would be diverted through a temporary culvert while a permanent drop structure and box culvert are constructed approximately 8m below the existing burn bed level. The environmental impacts of these works are considered in Volume 1, Part 3 – Environmental Assessment (Chapter 10: Road Drainage and the Water Environment) and Volume 1, Part 3 – Environmental Assessment (Chapter 11: Ecology and Nature Conservation).

7.3.39 It is expected that the construction of Option ST2A would take approximately 4.5 to 5 years to complete.

Option ST2B

7.3.40 Option ST2B includes construction of a 150m underpass structure. Insufficient space exists for an open excavation, therefore the walls that form part of the underpass would be constructed using large diameter bored piles. Installation would require heavy plant in close proximity to residential properties, Dunkeld & Birnam Station, the Highland Main Line railway and the Category A Listed station building. Construction would generate noise and vibration, with the potential to affect residential properties in the vicinity of the works. There is expected to be a potentially significant impact for those properties immediately adjacent to the underpass as bored piled walls are formed over a significant length, resulting in approximately 860 piles in total.

7.3.41 In order to construct the underpass, Inchewan Burn would be diverted through a temporary culvert with a permanent drop structure and box culvert constructed approximately 6m below the existing burn bed level. The environmental impacts of these works are considered in Volume 1, Part 3 - Environmental Assessment (Chapter 10: Road Drainage and the Water Environment) and Volume 1, Part 3 - Environmental Assessment (Chapter 11: Ecology and Nature Conservation).

7.3.42 It is expected that the construction of Option ST2B would take approximately 4 to 4.5 years to complete.

Options ST2C

7.3.43 Option ST2C is predominantly at-grade throughout the scheme with exception to the grade separated junction at Dunkeld which is raised by approximately 10m higher than the existing carriageway level, presenting construction challenges including provision of retaining walls of less than 2m high for short lengths on the east side adjacent to residential properties. Option ST2C is at-grade at the existing Dunkeld & Birnam Station therefore the alignment of Inchewan Burn is not altered as a result of the construction of Option ST2C.

7.3.44 The existing station access would be stopped-up and the existing car park lost to the on-line widening of the A9 for Option ST2C. This option proposes a replacement car park in the existing Birnam Industrial Estate providing a pedestrian underbridge below the A9 to maintain access to the station.

7.3.45 It is expected that the construction of Option ST2C would take approximately 2.5 to 3 years to complete.

Option ST2D

7.3.46 Option ST2D is predominantly at-grade throughout the scheme with significant earthworks complexities only in the vicinity of Dalguise Junction. Option ST2D is at-grade at the existing Dunkeld & Birnam Station. The alignment of Inchewan Burn is not altered as a result of the construction of Option ST2D.

7.3.47 The existing station access would be stopped-up and the existing car park lost to the on-line widening of the A9 for Option ST2D. This option proposes a replacement car park in the existing Birnam Industrial Estate providing a pedestrian underbridge below the A9 to maintain access to the station.

7.3.48 It is expected that the construction of Option ST2D would take approximately 2.5 to 3 years to complete.

7.4 Scope of DMRB Stage 2 Environmental Assessment

Study Area

7.4.1 The study area recommended by the DMRB and best practice guidance varies depending on the specific environmental parameter being assessed. Details of the study area extents for each parameter are provided in the specialist environmental chapters (Chapters 8 to 21).

Environmental Factors

7.4.2 Taking into account DMRB guidance, the following environmental factors have been subject to environmental assessment and are reported in Chapters 8 to 21 respectively of this DMRB Stage 2 Scheme Assessment Report:

- Chapter 8: Population - Land Use
- Chapter 9: Geology, Soils and Groundwater
- Chapter 10: Road Drainage and the Water Environment
- Chapter 11: Biodiversity
- Chapter 12: Landscape
- Chapter 13: Visual
- Chapter 14: Cultural Heritage
- Chapter 15: Air Quality
- Chapter 16: Noise and Vibration
- Chapter 17: Population - Accessibility
- Chapter 18: Material Assets and Waste
- Chapter 19: Climate
- Chapter 20: Human Health
- Chapter 21: Policies and Plans

7.4.3 The above list follows the general environmental topic structure suggested in DMRB LA 104 'Environmental assessment and monitoring' (Highways England et al., 2020), with the following minor amendments:

- The 'People and Communities' assessment as listed in DMRB LA 112 is separately reported as three chapters ('Population - Land Use', 'Population - Accessibility' and Population - Human Health) due to the large amount of information to be presented.
- The 'Landscape' assessment as listed in DMRB LA 107 is separately reported as two chapters ('Landscape' and 'Visual') due to its complexity and the large amount of information to be presented. At the request of Transport Scotland, an assessment of 'View from the Road' has been included in the 'Visual' chapter in accordance with the guidance provided in the withdrawn DMRB Volume 11, Section 3, Part 9: Vehicle Travellers (The Highways Agency et al, 1993b).
- The 'Geology and Soils' assessment as listed in DMRB LA 109 is reported under the chapter title 'Geology, Soils and Groundwater'.
- The groundwater assessment as listed in DMRB LA 113 is reported under the chapter title 'Geology, Soils and Groundwater'.

7.4.4 The purpose of Volume 1, Part 3 - Environmental Assessment (Chapter 21: Policies and Plans) is to identify policy relevant to each environmental parameter and to provide an overview of how each proposed route option complies with the identified policy. In accordance with DMRB LA 104, policies and plans were reviewed in the context of each of the topic chapters of this DMRB Stage 2 Scheme Assessment Report (Chapters 8-20), and the results of this are presented in *Appendix A21.1 (Assessment of Policy Compliance)* and summarised in Chapter 21 (Policies and Plans).

7.4.5 Assessment of the Dunkeld & Birnam Station access options required during construction of the proposed route options has been scoped in for Volume 1, Part 3 - Environmental Assessment (Chapter 14: Cultural Heritage), due to the potential for additional potential significant effects to the Category A Listed station building. For other environmental topics, the access options would be assessed at DMRB Stage 3, dependent on the Preferred Route Option.

UK Exit from the European Union

7.4.6 The UK left the EU on 31 January 2020, often referred to as 'Brexit'. As part of Brexit the UK and the EU agreed to an implementation period which came to an end on 31 December 2020. The European Union (Withdrawal) Act 2018 (as amended) (the 'Withdrawal Act') created a new body of law (known as 'retained EU law') with the aim to preserve the domestic effect of EU legislation as it applied to the UK immediately before the end of the transition period (31 December 2020).

7.4.7 Under the Withdrawal Act, EU-derived domestic legislation (such as existing environmental regulations that implement EU Directives) and direct EU legislation (such as EU regulations and decisions) which were in force immediately prior to the end of the transition period continue to form part of UK domestic law after 31 December 2020.

7.4.8 In January 2020, the European Union (Withdrawal Agreement) Act 2020 was also passed in the UK Parliament ('The Withdrawal Agreement Act 2020'). This amends the Withdrawal Act 2018 and makes provisions for ratifying the Brexit Withdrawal Agreement which sets the terms of the UK's withdrawal from the EU after 31st December 2020. Since 1 January 2021, The Withdrawal Agreement Act 2020 provides that "retained" EU law is preserved and converted into UK law. This includes EU-derived domestic legislation as well as European Directives. These continue to place legal obligations on the requirements for undertaking environmental assessment, and protection of the natural environment, including sites and species of European importance, in the UK.

7.4.9 Most of the UK's environmental and wildlife legislation is based on EU legislation. The key pieces of UK legislation to replace these include the Environment Bill, the Agriculture Bill and the Fisheries Bill which are currently being considered in parliament. These Bills predominantly apply to England, although some aspects will be relevant to the devolved nations.

7.4.10 In Scotland, the UK Withdrawal from the European Union (Continuity) (Scotland) Act 2021 ('The Continuity Act') received Royal Assent on 29 January 2021 and aims to enable the alignment of Scottish law with EU law going forward. This applies to areas which are devolved to Scotland, including the environment. This brings the EU's 4 core environmental principles which it uses when making laws that affect the environment into Scottish law as "guiding principles on the environment" and to ensure that these principles will continue to influence Scottish laws and policies.

7.4.11 This Act does 3 main things. It:

- gives Scottish Ministers power to keep devolved laws similar to EU laws
- ensures Scottish Ministers and public bodies pay attention to environmental principles when they make policies
- sets up a new organisation to replace the oversight of environmental law provided by the EU.

7.4.12 For the purposes of this DMRB Stage 2 Environmental Assessment, and at this stage of the transposition of pre-Brexit EU laws into UK and Scottish legislation, EU environmental laws relevant to the environmental factors that comprise this assessment are referred to in their pre-Brexit form, including European Commission references where relevant.

Cumulative Impacts

7.4.13 European Commission guidelines (European Commission, 1999) define cumulative impacts as those that result *'from incremental changes caused by other past, present or reasonably foreseeable actions together with the project'*. Cumulative impacts can be identified as either the combined effect of different environmental impacts on a single receptor/resource, or the combined effect of impacts from a number of different proposed developments.

7.4.14 During consideration of route options at DMRB Stage 2 there is limited opportunity to identify cumulative impacts, due to factors such as the early stage of development of the design, absence of details on construction programming and methods, and the need to consider multiple route options. The EIA Regulations (Scottish Government, 2017) require cumulative impacts to be considered as part of a statutory EIA, and as such this would form part of the scope for EIA at DMRB Stage 3. This would include identification of other major projects that could contribute to a cumulative impact. Due to the likelihood of overlapping construction programmes for some of the A9 dualling projects, this would be considered in the DMRB Stage 3 assessment.

7.4.15 It should be noted that whilst not reported as part of DMRB Stage 2 assessment, the potential for cumulative impacts is being considered at a strategic level, with discussions underway with statutory consultees through the A9 Environmental Steering Group (ESG). Similarly, opportunities for maximising benefits in terms of mitigation effectiveness are under consideration (for example reviewing woodland connectivity across several project study areas).

Community Objectives

7.4.16 At an early stage in the A9 Co-Creative Process, the Birnam to Ballinluig A9 Community Group generated community objectives. The seven objectives cover a wide range of topics but focus predominantly on environmental issues. Table 7.2 shows which environmental topic chapters contain assessment of operation of the proposed route options relevant to each objective. Details of how the relevant environmental topic contributes towards achieving the community objective in the operation phase is presented in *Appendix A7.1 (Mapping of Community Objectives Against DMRB Stage 2 Route Options).*

Table 7.2: A9 Co-Creative Process Community Objectives

Community Objectives		Relevant Environmental Topic Chapters
1	Reduce current levels of noise and pollution in the villages of Dunkeld, Birnam and Inver to protect human health and well-being of residents and visitors and to enable them to peacefully enjoy their properties and amenity spaces.	Chapter 8 (Population – Land Use) Chapter 15 (Air Quality) Chapter 16 (Noise and Vibration) Chapter 20 (Human Health)
2	Protect and enhance the scenic beauty and natural heritage of the area and its distinctive character and quality.	Chapter 10 (Road Drainage and the Water Environment) Chapter 11 (Biodiversity) Chapter 12 (Landscape) Chapter 13 (Visual)
3	Provide better, safer access on and off the A9 from both sides of the road while ensuring easy, safe movement of vehicular traffic and WCH through the villages, helping to reduce stress and anxiety and support the local community.	Chapter 8 (Population – Land Use) Chapter 17 (Population - Accessibility) Chapter 20 (Human Health)
4	Promote long-term and sustainable economic growth within Dunkeld and Birnam and the surrounding communities.	Chapter 8 (Population – Land Use)
5	Examine and identify opportunities to enhance the levels of cycling and walking for transport and leisure, including the improvement of existing footpaths and cycle ways, to promote positive mental health and well-being.	Chapter 12 (Landscape) Chapter 13 (Visual) Chapter 17 (Population - Accessibility) Chapter 20 (Human Health)
6	Ensure that all local bus, intercity bus services and train services are maintained and improved.	Chapter 8 (Population – Land Use) Chapter 17 (Population - Accessibility)
7	Preserve and enhance the integrity of the unique and rich historical and cultural features of the Dunkeld, Birnam and Inver communities, thereby supporting well-being and the local economy.	Chapter 8 (Population – Land Use) Chapter 14 (Cultural Heritage) Chapter 20 (Human Health)

7.4.17 As noted above, the DMRB Stage 2 assessment has considered the community's objectives where appropriate, and details as to how the proposed route options address the objectives are included in *Appendix A7.1 (Mapping of Community Objectives Against DMRB Stage 2 Route Options)*. A key message from the local community through the A9 Co-Creative Process is that the proposed scheme should carefully consider the health and well-being of local residents, which is reflected in the community's objectives. In accordance with DMRB LA 112, construction and operation of the proposed route options have been considered within the DMRB Stage 2 assessment. This Human Health assessment has utilised elements of the DMRB Stage 2 assessment (Volume 1, Part 3 – Environmental Assessment) relevant to human health, as well as a degree of professional judgement to identify differentiators and/or significant environmental effects between the proposed route options. The findings of the Human Health assessment are reported in Chapter 20 (Human Health).

7.4.18 While the impact on local businesses from a trunk road scheme is considered at this stage in the assessment process, it focusses on direct potential impacts on individual businesses. These direct potential impacts include requirement for demolitions, land-take, change in access (vehicles and WCH) and viability. Indirect potential impacts on businesses in Dunkeld and Birnam are considered as a whole and in general terms, taking into account indirect potential impacts arising from disruption during construction, the potential change in trade occurring from change in access during construction and operation, and the potential change in visitor numbers to Dunkeld and Birnam during construction and operation.

7.4.19 As the local community has expressed concerns regarding the impact on individual local businesses, which are integral to the local economy of Dunkeld and Birnam, further assessment has been undertaken as part of the DMRB Stage 2 assessment. This assessment has been completed by Professor J John Lennon, Dean of Glasgow School for Business and Society, Glasgow Caledonian University and considers the potential impacts on local business, tourist attractions and the local economy as a result of dualling works between the Pass of Birnam and River Tay crossing. Impacts during both construction and operation have been considered. The local business assessment is reported in *Appendix A7.2 (Perceived Tourism and Local Business Impacts of the A9 Dualling between the Pass of Birnam and Tay Crossing)*.

7.5 Environmental Reporting

7.5.1 This DMRB Stage 2 Scheme Assessment Report for the Pass of Birnam to Tay Crossing project has been prepared in accordance with the DMRB (Volume 5, Section 1, Part 2, TD 37/93[2]: Scheme Assessment Reporting).

Chapter Structure

7.5.2 Each environmental chapter provides the following:

- an introduction to the subject area;
- approach and methods used in the assessment;
- baseline conditions (i.e. the 'existing' situation);
- potential impacts of the proposed route options;
- potential mitigation, summarising types of mitigation that would be developed for the Preferred Route Option during the DMRB Stage 3 assessment;
- summary of the route options assessment, including identification of potential differentiators, contribution to community objectives and comparative assessment where potential differentiators have been identified;
- scope of the DMRB Stage 3 assessment, highlighting components that should be considered during development of the Preferred Route Option design; and
- references.

General Approach

<u>Baseline Conditions</u>

7.5.3 The assessment of potential impacts on each environmental parameter is undertaken in comparison to baseline conditions which were determined through field survey, desk-based review and consultation. Baseline conditions describe the existing environmental conditions in the study area and in the wider area as pertinent to the particular environmental parameter.

[2] TD 37/93 'Scheme Assessment Reporting' and other associated documents remain current in Scotland, despite being withdrawn from DMRB.

7.5.4 This DMRB Stage 2 assessment process was initially informed by baseline data collected in 2015 to 2016. The Stage 2 assessment period was then extended due to additional community engagement undertaken through the A9 Co-Creative Process (refer to Volume 1, Part 3 – Environmental Assessment (Chapter 6: Summary of Previous Assessment)). The baseline data have been reviewed and are considered to remain a valid basis for the purposes of comparative route assessment at DMRB Stage 2. Details of baseline data collection are presented in each environmental chapter. Further verification and additional data collection would be undertaken as part of the DMRB Stage 3 assessment of the Preferred Route Option. In accordance with DMRB LA 104, the future baseline scenario is provided in each environmental chapter where appropriate.

7.5.5 It should be noted that this DMRB Stage 2 assessment was prepared prior to and during the global COVID-19 coronavirus pandemic. Throughout 2020 and in early 2021, there have been significant and extensive restrictions in place in Scotland on the movement of people and the activities that are permitted. Due to the duration and extent of such restrictions, some of the baseline and survey updates have not been achievable, and traditional methods of public engagement have also been affected.

Potential Impacts and Effects

7.5.6 The general approach to assessment is based on the determination of the potential for significant effects assessed from a combination of the sensitivity or importance of the baseline conditions and the magnitude of potential impacts. This process is described in the respective environmental chapters, and where this approach was not appropriate (e.g. consideration of policy compliance in Chapter 21 (Policies and Plans)), alternative approaches are described and justified.

7.5.7 It should be noted that the magnitude and significance reported within the 'Potential Impacts and Effects' section of each chapter has been considered assuming embedded mitigation (design measures which are integrated into a project for the purpose of minimising environmental effects) but in the absence of essential mitigation (mitigation critical for the delivery of a project which can be acquired through statutory powers). The 'Summary of Route Option Assessment' then takes into account the potential for essential mitigation where possible.

7.5.8 For the purposes of this DMRB Stage 2 Scheme Assessment Report, construction impacts are considered to be temporary. Impacts may start during construction (e.g. land-take) but if they persist during operation, they are considered operational impacts. Any exceptions to this are noted. Operational impacts are considered long-term or permanent, again with any exceptions being noted.

Potential Mitigation

7.5.9 As noted within the respective environmental chapters, the designs developed for a DMRB Stage 2 assessment are not developed in enough detail to allow essential mitigation proposals to be fully confirmed, and the assessment therefore largely identifies 'standard' or anticipated mitigation taking into account best practice, legislation and appropriate guidance, which would be further developed and refined during the DMRB Stage 3 assessment. Generally, the potential for effects of 'Moderate' or greater significance would be identified as priorities for mitigation. However, the need for mitigation would be confirmed during the DMRB Stage 3 assessment of the Preferred Route Option.

Summary and Comparison of Proposed Route Options

7.5.10 This section provides a summary of the DMRB Stage 2 assessment of potential impacts and effects for the proposed route options, taking into account potential mitigation.

7.5.11 For the comparison of proposed route options, two aspects are considered; whether the potential for residual effects would be considered significant in the context of the EIA Regulations; and whether any of the potential impacts and effects identified differ sufficiently between proposed route options such that they can be considered a differentiator and need to be considered as part of the overall identification of the Preferred Route Option (which takes into account environmental considerations as well as engineering, economic and traffic considerations).

7.6 Consultation

General Approach

7.6.1 Consultation has been undertaken in accordance with guidance provided in Planning Advice Note (PAN) 1/2013: Environmental Impact Assessment (Scottish Government, 2013) and with cognisance of PAN 3/2010: Community Engagement (Scottish Government, 2010). The importance of successful consultation has been strengthened by the Planning etc. (Scotland Act) 2006 and by the publication of best practice guidance set out in PAN 1/2013.

7.6.2 Communication and engagement have been developed to complement the above guidance and the guidance set out in Transport Scotland's publication, 'A9 Dualling Engaging with Communities' (Transport Scotland, 2016). In accordance with best practice, public participation is being undertaken as part of the progression of the A9 Dualling: Pass of Birnam to Tay Crossing project. Where appropriate, issues raised through the public participation process are taken into consideration as part of the environmental assessment process.

7.6.3 At DMRB Stage 2, the consultation sought to:

- ensure that statutory consultees and other bodies with a particular interest in the environment are informed of the proposal and provided with an opportunity to comment;
- obtain baseline information regarding existing environmental site conditions;
- establish key environmental issues and identify potential impacts to be considered during the environmental assessment;
- identify those issues which are likely to require more detailed study and those which can be justifiably excluded from further assessment; and
- provide a means of identifying the most appropriate methods of impact assessment.

Statutory and Non-Statutory Consultees and Forums

7.6.4 A comprehensive stakeholder database was created with statutory and non-statutory consultees prioritised in terms of their communication needs and potential impact on the design development of the proposed route options. Engagement with statutory consultees and key agencies was led by Transport Scotland and supported by Jacobs. Stakeholders were placed within six distinct groups to help prioritise engagement: statutory consultees; landowners; local communities; local businesses; press and media; and specialists and user groups. The level of engagement with stakeholders maximised the opportunity to take on board views, opinions and aspirations and implement these, if practical, during the design phase and in advance of the DMRB Stage 2 assessment.

7.6.5 A number of Stakeholder Forums were set up to bring together groups of similar interest and to facilitate two-way flow of information. Of particular relevance to the DMRB Stage 2 environmental assessment were the ESG and the Environmental Forum, allowing environmental issues associated with the dualling programme to be fully considered and agreed through the design process.

7.6.6 In addition to Transport Scotland and the design consultant representatives, the membership of the ESG and Environmental Forum are provided in Table 7.3. The ESG is made up of the statutory environmental consultees and the Environmental Forum includes all of those plus additional environmental stakeholders.

Table 7.3: Stakeholder Forum Membership

Environmental Steering Group	
Cairngorms National Park Authority	Scottish Environment Protection Agency (SEPA)
Historic Environment Scotland (HES)	NatureScot[3]
Perth & Kinross Council (PKC)	The Highland Council
Environmental Forum	
All attendees from the ESG	Royal Society for the Protection of Birds (RSPB)
Badenoch and Strathspey Conservation Group	Scottish Badgers
British Deer Society	Scottish Wildlife Trust
Buglife	Spey District Fisheries Board
Findhorn, Nairn, and Lossie Fisheries Board	Tay District Salmon Fisheries Board
Forestry Commission Scotland (now Forestry and Land Scotland)	The Woodland Trust

7.6.7 The ESG meets on a regular (usually monthly) basis, covering all A9 Dualling Programme projects. This enables progress and design updates to be provided, and for the statutory stakeholders to provide valuable input to the process. At DMRB Stage 2, this has included agreement of survey scope and extent, review of assessment or modelling methods and approach, discussion of potential conflict points, and input to route options being considered.

7.6.8 The Environmental Forum met quarterly, from 2015 to 2017, providing updates on projects and key findings of the progressing assessments, and enabling all attendees to provide input and share information.

7.6.9 In addition to the ESG and the Environmental Forum, other stakeholder forums include:

- Accessibility Forum;
- Business and Community Group Forum;
- Landscape Forum;
- Local Authorities and Regional Transport Partnerships Forum;
- Non-Motorised User (NMU) Forum; and
- Operation and Maintenance Forum.

7.6.10 These forums are used to present information regarding emerging designs and to generate feedback that can be incorporated into those designs and assessment where relevant.

7.6.11 The consultation list which relates specifically to the environmental assessment beyond the ESG and the Environmental Forum is provided in Table 7.4.

[3] Scottish Natural Heritage (SNH) was rebranded NatureScot in August 2020.

Table 7.4: DMRB Stage 2 Environmental Consultees

Consultee	
Bat Conservation Trust	Rivers and Fisheries Trusts of Scotland
Botanical Society of the British Isles (Mid Perthshire)	Save Scotland's Red Squirrels
Botanical Society of the British Isles (East Perthshire)	Scottish Government Rural Payments and Inspections Directorate (UK)
British Horse Society	Scottish Mink Initiative
Dunkeld and Birnam Angling Association	Scottish Wildcat Association
Marine Scotland	SUSTRANS
National Trust for Scotland	Tayside Biodiversity Partnership and Geodiversity
National Biodiversity Network (NBN) Gateway	Tayside Amphibian and Reptile Group
Perth and District Anglers Association	Tayside Bat Group
Perth Bat Group	Tay Riparian Owners
Pike Anglers Association for Scotland	The Grayling Society
Raptor Study Group	

7.6.12 In total, 34 organisations were contacted in March 2015 to inform them of the DMRB Stage 2 environmental assessment. Consultees were provided a Geographic Information System (GIS) shapefile and/or pdf drawing of a 500m study area with the letter. This provided consultees the opportunity to provide any baseline information and identify any key issues that should be considered in the assessment.

7.6.13 Follow-up emails were sent to environmental consultees between March and May 2015 to either confirm receipt of a response, or if no response was received, to provide the opportunity for consultees to request to be removed from the consultation list.

7.6.14 Further requests to environmental consultees for baseline have been made as required during the preparation of this DMRB Stage 2 Scheme Assessment Report.

7.6.15 The baseline data and responses received have been taken into account in the development of the proposed route options and the subsequent environmental assessment.

CPRO Consultation Responses

7.6.16 Following the selection of the CPRO in June 2018, members of the ESG were consulted between August 2018 and November 2018. Meetings with consultees allowed Jacobs to present the proposed design and obtain relevant feedback and guidance on the CPRO.

DMRB Stage 2 Consultation Responses

<u>Scope of Assessment</u>

7.6.17 Due to the scale and nature of the proposals, all environmental topic areas as identified in the DMRB were scoped 'in' for further environmental assessment. The scope of assessment for each topic area was informed by review of previous studies and by relevant regulations and best practice guidance. During the DMRB Stage 2 consultation, consultees also had an opportunity to provide comment on the scope of the environmental assessment.

Consultee Feedback

7.6.18 Feedback from stakeholder consultation, the ESG and Environmental Forum meetings was reviewed by environmental specialists undertaking the assessments as presented in this DMRB Stage 2 Scheme Assessment Report. Where appropriate, feedback and guidance from consultees has informed the assessments undertaken and has input to the development of the proposed route option designs. Previous consultation findings and the baseline information provided by consultees has also been used to inform the assessment and is reported separately for each environmental topic area.

7.6.19 A draft of Part 3 (Environmental Assessment) of this DMRB Stage 2 Scheme Assessment Report was issued to the relevant ESG members (PKC, SNH, HES and SEPA) to provide the opportunity for these statutory consultees to comment on the assessment undertaken to date over a six-week consultation period from 1 August to 12 September 2019. Comments received following this consultation were reviewed and considered by technical specialists and updates were incorporated into the DMRB Stage 2 Scheme Assessment Report where considered appropriate. Relevant comments provided outwith the period that would enable incorporation into the DMRB Stage 2 Scheme Assessment Report, would be considered during the DMRB Stage 3 assessment in relation to the Preferred Route Option.

7.6.20 Following revisions of the DMRB Guidance in late 2019, early 2020, the DMRB Stage 2 Scheme Assessment Report has been updated and further consultation was undertaken with the ESG in April 2021 on Volume 1, Part 3 - Environmental Assessment. As with other consultations, comments received following this consultation were reviewed and considered by technical specialists and updates were incorporated into the DMRB Stage 2 Scheme Assessment Report where considered appropriate.

Consultation at DMRB Stage 3

7.6.21 Further consultation would be required with statutory consultees, non-statutory consultees and landowners. The nature of these consultations is yet to be confirmed, however, the intention is that the various forums and groups referred to in this chapter would continue to provide input, and there would be ongoing workshops and meetings. Ongoing liaison would occur throughout the design process in the form of telephone discussions, emails and letters.

A9 Co-Creative Process, Public Engagement and Exhibitions

7.6.22 Details of public engagement and exhibitions related to the A9 Co-Creative Process and consultation that has informed this DMRB Stage 2 assessment are described in Volume 1, Part 3 – Environmental Assessment (Chapter 6: Summary of Previous Assessment) and Volume1, Part 1 – The Scheme.

7.6.23 A public consultation event held in the Birnam Arts and Conference Centre on 26 and 27 March 2019 provided details on the CPRO including the key environmental challenges and benefits. Alternative options were also presented at the event, which outlined how each option may help to solve some of the challenges with the CPRO and any impacts associated with the alternative options. This provided an opportunity for members of the public to provide comment and feedback on the CPRO and alternative options.

7.6.24 On 16 and 17 May 2019, a public drop-in session was held in the Birnam Arts and Conference Centre. This event provided local communities and road users with an update on the design process for the section of the A9 to be dualled between Pass of Birnam and Tay Crossing. At this event, a number of Additional Whole Route Options were shown, which had been developed using the options shown at the March 2019 consultation events. These were assessed alongside the CPRO in the DMRB Stage 2 assessment.

7.6.25 It is envisaged that a further public exhibition would be held to present the Preferred Route Option to the public once it has been selected and again at the conclusion of the DMRB Stage 3 assessment, concurrent with the publication of draft Orders and Environmental Impact Assessment Report.

7.6.26 Public consultation events and Community Engagement Events supplement the formal consultation process (i.e. leading to publication of draft Orders and Environmental Impact Assessment Report). Queries and comments raised following the public exhibitions held in January 2016, March 2019, May 2019, the results of the A9 Co-Creative Process, including the Community's objectives, and the workshops held with the Community Group in December 2019 and January 2020 have, where appropriate, been taken into account during the development of the design and the environmental assessment process.

7.7 References

Legislation

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8. Population - Land Use

8.1 Introduction

8.1.1 This chapter presents the Design Manual for Roads and Bridges (DMRB) Stage 2 assessment of the potential impacts and effects of each of the proposed route options on Population - Land Use.

8.1.2 This assessment considers the following categories of land use receptors:

- private property & housing - land, buildings and infrastructure for the purpose of residential use in centres of population and as scattered properties;
- community assets - buildings and infrastructure in centres of population providing a service/resource to a community, e.g. education facilities, healthcare, post offices, village halls and places of worship;
- community land - land which is an established public recreational resource, such as playing fields, country parks, waterways or areas identified as 'Open Space' within the Local Development Plan (LDP). Informal areas of community land which permit public access such as woodlands are also included;
- development land - land identified in national or local plans, policies or strategies for development (including intensification of existing use) and land with planning permission. For the purposes of this assessment this includes land allocated for a change from the existing land use and also land safeguarded for its existing use through the Perth & Kinross Council (PKC) Local Development Plan 2 (PKC LDP2) (PKC, 2019) and areas of land with approved planning applications as granted or under consideration by the Local Planning Authority (PKC);
- businesses - land, buildings and infrastructure for the purpose of business/commercial use in centres of population, employment sites and scattered properties; and
- agricultural land holdings - land and associated infrastructure for the purpose of agricultural production, e.g. arable farming, dairy farming etc. For the purposes of this assessment this also includes forestry (land used for the growing of trees to produce wood and wood products for commercial purposes), sporting interests (land used for activities such as shooting and stalking over agricultural land and woodland, as well as fishing activities in and on lochs, reservoirs, rivers, burns, canals and ponds) and other agricultural, forestry and sporting land (land within agricultural, forestry and sporting interests that is not utilisable for commercial purposes e.g. tracks, open ditches, yards and unusable land).

8.1.3 The assessment includes consideration of the potential impacts of land-take (e.g. demolition of a building, and loss and/or severance of land), change in accessibility and introduction or removal of severance, and direct/indirect impacts on businesses and on viability.

Legislative and Policy Background

8.1.4 A summary of the national, regional and local planning policies and guidance relevant to population (land use) is provided. These policies are further reviewed throughout this Environmental Assessment where relevant in other environmental discipline chapters.

8.1.5 The Scottish Government, under Scottish Planning Policy (SPP) (Scottish Government, 2014a; Revised 2020), indicates that the fundamental principle of sustainable development is that it integrates economic, social and environmental objectives. The aim is to achieve the right development in the right place. SPP guides the planning system to promote development that supports the move towards a more economically, socially and environmentally sustainable society. The following principles, as set out in paragraph 29 of SPP, are of relevance to land use, community and private assets:

- *'giving due weight to net economic benefit;*
- *responding to economic issues, challenges and opportunities, as outlined in local economic strategies;*
- *supporting good design and the six qualities of successful places;*
- *making efficient use of existing capacities of land, buildings and infrastructure including supporting town centre and regeneration priorities;*
- *supporting delivery of accessible housing, business, retailing and leisure development;*
- *supporting delivery of infrastructure, for example transport, education, energy, digital and water;*
- *improving health and well-being by offering opportunities for social interaction and physical activity, including sport and recreation;*
- *having regard to the principles for sustainable land use set out in the Land Use Strategy;*
- *protecting, enhancing and promoting access to natural heritage, including green infrastructure, landscape and the wider environment; and*
- *avoiding over-development, protecting the amenity of new and existing development and considering the implications of development for water, air and soil quality.'*

8.1.6 The National Planning Framework 3 (NPF3) (Scottish Government, 2014b) is a strategy for all of Scotland, championing the most successful places and supporting change in areas where, in the past, there has been a legacy of decline. NPF3 brings together plans and strategies in economic development, regeneration, energy, environment, climate change, transport and digital infrastructure to provide a coherent vision of how Scotland should evolve over the next 20 to 30 years. NPF3 places importance on the benefits that land use possesses in that it '*encourages us to make the best use of assets to support primary activities including food production, flood management and carbon storage*' (p.44). It should be noted that a consultation draft of NPF4 was published in November 2021. NPF4 is a long term spatial plan (to 2050) for Scotland that will align with the outcomes in the National Performance Framework and will set out where development and infrastructure is needed to support sustainable and inclusive growth. It will guide spatial development, set out national policies, designate national developments and reflect regional spatial priorities. As a draft, NPF4 may be subject to change through the consultation process, however its content is not expected to influence the selection of a route option and it has not been considered in the assessment at this stage, but it will be considered in more detail during DMRB Stage 3. Prior to the consultation of NPF4 a Position Statement was published in November 2020 (Scottish Government, 2020b), which set out ideas for changes to policy from NPF3 for four outcomes:

- A Plan for Net-Zero Emissions
- A Plan for Resilient Communities;
- A Plan for a Wellbeing Economy; and
- A Plan for Better, Greener Places.

8.1.7 Table 8.1 outlines the main local planning policies relevant to this assessment on population and land use.

Table 8.1: Summary of Key Planning Policies for Population – Land Use

Planning Document (Status)	Title	Relevant Policies/Supplementary Guidance
Strategic Development Plan (Approved October 2017)	TAYplan Strategic Development Plan (2016-36) (TAYplan 2017)	▪ Policy 2: Shaping Better Quality Places ▪ Policy 9: Managing TAYplan's Assets
Local Development Plan	Perth & Kinross Local Development Plan 2 (PKC LDP2) (PKC, 2019)	▪ Policy 7: Employment and Mixed-Use Areas ▪ Policy 8: Rural Business and Diversification ▪ Policy 9: Caravan Sites, Chalets and Timeshare Developments ▪ Policy 14: Open Space Retention and Provision ▪ Policy 16: Social, Cultural and Community Facilities ▪ Policy 17: Residential Areas ▪ Policy 40: Forestry, Woodland and Trees ▪ Policy 42: Green Infrastructure ▪ Policy 50: Prime Agricultural Land ▪ Policy 51: Soils ▪ Policy 54: Health and Safety Consultation Zones
		Supplementary Guidance ▪ Open Space Provision for New Developments ▪ Green and Blue Infrastructure

8.1.8 An assessment of the compliance of the proposed scheme against all planning policies and plans relevant to this environmental topic is reported in Volume 1, Part 3 - Environmental Assessment (Chapter 21: Policies and Plans) and *Appendix A21.1: Assessment of Policy Compliance)*.

8.2 Approach and Methods

Scope and Guidance

8.2.1 The assessment at DMRB Stage 2 is based on guidance contained in DMRB LA 112 'Population and Human Health' first published in October 2019 (Highways England et al., 2020a) (hereafter referred to as 'DMRB LA 112'). Environmental assessment of population and human health effects reports on the elements of 'land use and accessibility' and 'human health'. Due to the volume and complexity of data covered under 'Population and Human Health' in relation to the proposed route options, the findings are reported in three linked chapters of this report; this chapter covering 'Population - Land Use', Volume 1, Part 3 - Environmental Assessment (Chapter 17: Population - Accessibility; and Chapter 20: Human Health).

8.2.2 In addition, DMRB LA 109 'Geology and Soils' published in October 2019 replaces DMRB Volume 11, Section 3, Part 11 and Part 6 (Highways England et al, 2019). As agricultural land-take is material to the assessment of agricultural holdings land-take impacts on soils, including Land Classification for Agriculture (LCA) are reported in this chapter and also in Volume 1, Part 3 - Environmental Assessment (Chapter 13: Geology and Soils) in accordance with DMRB LA 109.

8.2.3 Guidance provided in DMRB LA 104 'Environmental Assessment and Monitoring' (Highways England et al, 2020b) was also utilised for the purposes of the land use assessment.

8.2.4 Where relevant and to support the assessment, cognisance of previous DMRB guidance in relation to land and community effects was taken where professional judgement identified this was relevant and would better inform the assessment. For example, using sensitivity and/or magnitude of impact criteria referenced in the superseded DMRB guidance that is of relevance to the assessment approach contained in DMRB LA 112 and DMRB LA 109.

8.2.5 The potential impacts and effects of the proposed route options on the following community and private assets is included in the assessment as these are known to be present in the study area: private property & housing, community assets, community land, development land, businesses and agricultural land holdings.

Study Area

8.2.6 The assessment includes a general study area for baseline conditions which extends to a corridor of 500m from the centre line of the proposed route options. Where appropriate, the study area may be reduced or extended to support the impact assessment e.g. the assessment of potential impacts on land-take is confined to those assets which are directly affected by the proposed route options, whereas the accessibility assessment will take cognisance of any potential effects of severance which may extend beyond the 500m study area.

8.2.7 The 500m study area is shown on Figures 8.1 to 8.6.

Baseline Conditions

8.2.8 Baseline receptors considered within this assessment are described in paragraph 8.1.2.

8.2.9 It should be noted that the categorisation of land use may fall into one or more of the baseline receptor categories listed in paragraph 8.1.2. In order to take full account of the effects on land use, assessment of impacts and effects is reported for current land use (e.g. community land), and future land use where land has been identified for alternative development, including relevant planning applications and development land allocations. It should be noted that where land is safeguarded for use in the LDP which is consistent with its existing use, the assessment is reported only against the existing use in order to avoid double counting of potential impacts and effects.

8.2.10 Planning permissions and pending planning applications in the three-year period 01 October 2018 and valid up to 01 October 2021 were assessed. Using professional judgement, the following application types excluded, where the proposed scheme was deemed unlikely to have a direct impact on the application, on the basis that they relate to minor works or procedural aspects and would not alter the number of location of receptors captured in the baseline:

- householder applications for improvements/extensions;
- local commercial and business applications for minor improvement works and alterations;
- change of use;
- applications for advertisement consent;
- temporary planning permissions (which are likely to expire prior to commencement of construction); and
- enforcement actions.

8.2.11 For the purposes of this assessment, where a community asset is provided by a privately-owned commercial business (e.g., a post office within a local general and convenience shop), this has been assessed as a community facility, with any potential impacts and effects being reported under this heading.

Desk-based Assessment

8.2.12 Baseline conditions for the above receptors were identified through a review of the following:

- review of aerial photographs;
- review of digital Ordnance Survey (OS) maps;
- Jacobs' Geographical Information System (GIS) database;
- Jacobs' TrackRecord providing information on land ownership and occupation;
- online based search for business property and community assets;
- AddressBase® Plus;
- Office for National Statistics (ONS) (2018);
- Scottish Index of Multiple Deprivation (SIMD) 2020 (Scottish Government, 2020b);
- Statistics (Office for National Statistics, 2018);
- Scotland's Census (2011);
- Macaulay Land Use Research Institute (MLURI), now the James Hutton Institute, Land Capability for Agriculture (LCA) data;
- A9 Route Improvement Strategy – Dualling of Birnam to Tay Crossing, Stage 2 Options Assessment Report, Part 2 Environmental Assessment, Volume 1 Environmental Report, Volume 2 Figures, Volume 3 Appendix, June 2011 (Transport Scotland, 2011);
- TAYplan Strategic Development Plan (TAYplan, 2017);
- Perth & Kinross Local Development Plan 2 (PKC LDP 2) (PKC, 2019);
- extant planning applications provided by PKC (01 March 2018 to 01 March 2021); and
- online resources of VisitScotland.

8.2.13 Available LCA data (supplied by James Hutton Institute, 2016) were used to indicate the land capability class within the study area. This classification system ranks land on the basis of its potential productivity and cropping flexibility. This is determined by the extent to which the physical characteristics of the land (soil, climate and relief) impose long term restrictions on its use and capability to grow certain types of crops and grass. Land is classified into seven main classes, some of which have subdivisions, with Class 1 being the best quality land and Class 7 the poorest. These can be simplified into four land use categories which are broadly indicative of the land's agricultural capability:

- arable agriculture (LCA classes 1 to 3.1);
- mixed agriculture (LCA classes 3.2 to 4.2);
- improved grassland (LCA classes 5.1 to 5.3); and
- rough grazing (LCA classes 6.1 to 7).

8.2.14 Classes 1, 2 and 3.1 are known as prime quality land and Classes 3.2 to 7 are known as non-prime land.

Consultation

8.2.15 A summary of the consultation is reported in Volume 1, Part 3 - Environmental Assessment (Chapter 7: Overview of Environmental Assessment, Section 7.6 (Consultation)). Key consultations that have informed this assessment are summarised in the following paragraphs.

8.2.16 Consultation with PKC was undertaken to identify consented planning applications submitted between 01 October 2018 and 01 October 2021 (i.e. within a three-year implementation timeframe). The three-year assessment period was chosen to reflect the standard duration for commencing development following the granting of planning permission. Accordingly, applications consented prior to October 2018 would have been discounted since they would have either been implemented or planning permission would have lapsed.

8.2.17 Information in relation to commercial businesses and agricultural, forestry and sporting activities was gathered during ongoing consultation with business owners, landowners and land managers as part of the property and landowner consultations.

Assessment of Potential Impacts and Effects

Private Property & Housing and Businesses

8.2.18 The assessment of potential impacts and effects of the proposed route options on private property & housing and on businesses is focused on direct land-take, changes in access and impacts on viability. In addition to these direct impacts and effects, indirect effects (no significant effect, significant beneficial effect, or significant adverse effect) may arise, particularly for people and businesses that utilise the existing A9. Indirect effects relate to a variety of factors and key considerations along with information gained during consultations and combined with professional judgement is used to assess these.

Land-take

8.2.19 The estimated land-take is based on the footprint of the proposed route options, which takes into account potential land required to enable design refinement and operational maintenance. Land that may be required for construction has also been considered within the footprint. Additional land-take, such as landscape planting or other essential mitigation, is not included as this cannot be accurately quantified at this stage. This would be identified during the DMRB Stage 3 assessment in consultation with any potentially affected landowners.

8.2.20 The loss of land is calculated to the nearest square metre. Where land-take areas are reported in hectares and rounded to one decimal place within this chapter this equates to the nearest 1,000m^2. Land-take is reported in hectares for individual land interests. Where multiple land parcels would be affected there may be minor differences between the total land-take values reported when compared to the sum of the individually reported land-take areas. This is also due to the effect of rounding to two decimal places.

Sensitivity

8.2.21 The assessment on private property & housing and business property has been undertaken by determining the sensitivity and magnitude according to the criteria in Table 8.2 and Table 8.3. The significance of potential effect was then determined using professional judgement and in line with Table 8.4.

8.2.22 Table 8.2 provides details of the criteria for assessing the sensitivity of private property & housing and business property. This table also includes details for community assets and community land.

Table 8.2: Sensitivity criteria for private property & housing, businesses and community assets/land

Sensitivity	Description
Very High/High	▪ Private property & housing and businesses covering >1ha and/or >30 properties. ▪ Assets used very frequently by the majority of the community (e.g. schools and community halls). ▪ Assets or land used very frequently by the majority of the community and that attracts users nationally (e.g. national parks). ▪ Cemeteries.
Medium	▪ Private property & housing and businesses covering <1ha and/or <30 properties. ▪ Assets or land used frequently by the majority of the community and that attracts users from a regional catchment (e.g. country parks, forests and other land managed in such a way as to attract visitors from a regional catchment). ▪ Locally important assets or land used frequently by the majority of the community land (e.g. local parks and playing fields).
Low	▪ Derelict or permanently unoccupied properties. ▪ Assets or land used infrequently by the minority of the community (e.g. unmanaged woodland with limited existing accessibility provision).
Negligible	▪ Community land used very infrequently by the minority of the community with no or limited existing accessibility provision.

Magnitude

8.2.23 As indicated in Table 8.3, the magnitude of impacts was determined based on the degree of change from baseline conditions in terms of land-take and/or severance.

Table 8.3: Impact magnitude criteria for private property & housing, businesses and community assets/land

Magnitude	Description
Major	Loss of resource and/or quality and integrity of resource; severe damage to key characteristics, features or elements. For example, where there is a combination of: ▪ demolition of property; ▪ permanent land-take of >50% of land or asset; ▪ introduction or removal of complete severance with no accessibility provision; ▪ a change in vehicle journey distance of over 5km to/from property, land or asset; and ▪ viability of land use compromised.
Moderate	Partial loss of/damage to key characteristics, features or elements. For example, where there is a combination of: ▪ permanent land-take of between 15% and 50% of land or asset; ▪ introduction or removal of severe severance with limited accessibility provision; ▪ a change in vehicle journey distance of between 2.5km and 5km to/from property, land or asset; and ▪ viability of land use not compromised.
Minor	A discernible change in attributes, quality or vulnerability; minor loss of, or alteration to one (maybe more) key characteristics, features or elements. For example where there is a combination of: ▪ permanent land-take of <15% of land or asset; ▪ introduction or removal of partial severance with adequate accessibility provision; ▪ a change in vehicle journey distance between 0.5km and 2.5km to/from property, land or asset; and ▪ viability of land use not compromised.

Magnitude	Description
Negligible	Very slight change from the baseline condition; change hardly discernible.
No change	No loss or alteration of characteristics, features, elements or accessibility; no observable impact in either direction.

8.2.24 It is recognised that in certain circumstances the proposed scheme may make a beneficial contribution to the future development and viability of property and housing, businesses and community assets/land, such as through change in access. Where this is assessed, beneficial impacts and effects are reported.

8.2.25 The DMRB Stage 2 design for this project does not show the detail of revised accesses to individual property and housing and business properties alongside the A9, where properties currently have an access that would need to be stopped up as part of the dualling works (either stopping up of an individual direct access onto the A9, or of a side road which provides access). For the purposes of assessing the potential impacts and effects of the proposed route options, it has been assumed that some form of revised access would be provided to any such affected properties as this is a legislative requirement. The technical feasibility of these access solutions has been sufficiently considered as part of the design development (as reported in this DMRB Stage 2 Scheme Assessment Report, Volume 1, Part 1 - The Scheme (Chapter 2: Existing Condition and Chapter 4: Description of Route Options) to confirm that this is achievable.

8.2.26 Where direct access onto the A9 has been provided as part of DMRB Stage 2 design, the potential impact and effect on vehicle access for private property & housing and business properties has been assessed. This is focused on properties where, as a result of the proposed route options, current access arrangements to/from the property would be altered.

8.2.27 The potential effects are described with information on the expected increase or decrease in journey distance provided in relation to the direction of travel (north or south) for vehicle users travelling to/from the property to/from the A9. Any changes in journey distance have been calculated based on the assumption that either the existing A9 or the proposed route option would be the preferred route to be used to travel north or south. Where there are different options to maintain vehicle access to the existing A9 or the proposed route option, the shortest route that negates the need for an at-grade right turn manoeuvre has been assessed. The magnitude of impact for accessibility was adapted from distances for pedestrians to distances for vehicles using DMRB Volume 11, Section 3, Part 8, Pedestrians, Cyclists, Equestrians and Community Effects (The Highways Agency et al., 1993) and determined using professional judgement and as outlined in Table 8.4.

8.2.28 DMRB LA 112 indicates that the scope of assessment should include consideration of adverse or beneficial effects of severance. Potential adverse or beneficial effects on severance are considered in relation to walkers, cyclists and horse-riders (WCH) as well for vehicle access. The DMRB Stage 2 design for this project does not show the detail of revised accesses to properties or diversions to path networks, which may be used to access private properties and housing, business property and community assets/land facilities. However, sufficient detail is provided to identify new severance and relief from severance.

8.2.29 Where new severance may arise, as a result of the proposed route options, or where existing severance may be increased, professional judgement was used to qualitatively assess how the proposed route options would alter the accessibility provision to property and land. This included assessment of the impacts and effects on vulnerable groups. Similarly, professional judgement was used to qualitatively assess relief from severance. The qualitative assessment takes consideration of likely changes in traffic flows, journey distance and imposition of hindrances.

8.2.30 Where potential impacts and effects on WCH are identified through severance of existing paths, such as the core path network, this is assessed in Volume 1, Part 3 - Environmental Assessment (Chapter 17: Population - Accessibility).

8.2.31 In assessing whether the acquisition of land compromises overall viability of property and housing, professional judgement is used to determine whether there would be the potential for a likely change in future use of the property/land. It should be noted that this is not an economic assessment of viability and does not provide more detailed analysis of the scale of effect on overall viability.

8.2.32 In the event of the loss of property and housing, business property and community assets/land, the potential provision of financial compensation for land lost, severance, injurious affection and disturbance would be assessed by the District Valuer. However, the determination of financial compensation is outside the remit of the assessment process and is therefore unknown at this stage of the project. Potential compensation payments were not considered as mitigation.

8.2.33 The overall significance of effect was determined taking into account sensitivity and magnitude, as set out in Table 8.4. This is adapted from Table 3.8.1 in DMRB LA 104 to reflect that very high and high sensitivities are combined. Being precautionary, significance of effect for the very high sensitivity category from Table 3.8.1 of DMRB LA 104 are used for the very high/high sensitivity value. Generally, where two significance categories are provided, the assessment reports the higher of the two significance categories to provide a worst-case precautionary approach. Where such an adjustment is made and the lower significance category is reported, an explanation is provided within the assessment.

8.2.34 Effects are considered adverse, unless otherwise stated. Potential effects are considered 'significant' where the assessment reports effects of Moderate or higher significance, which are shown in bold in Table 8.4.

Table 8.4: Matrix for determination of significance of effect

Magnitude / Sensitivity	No Change	Negligible	Minor	Moderate	Major
Very High/High	Neutral	Slight	**Moderate** or **Large**	**Large** or **Very Large**	**Very Large**
Medium	Neutral	Neutral or Slight	Slight	**Moderate**	**Moderate** or **Large**
Low	Neutral	Neutral or Slight	Neutral or Slight	Slight	Slight or **Moderate**
Negligible	Neutral	Neutral	Neutral or Slight	Neutral or Slight	Slight

Indirect Impacts on Businesses

8.2.35 Indirect impacts on businesses within the communities of Dunkeld, Birnam and Inver were assessed, taking into account the following key considerations:

- disruption during construction arising from the scale, nature and duration of construction activities;
- change in trade for businesses resulting from construction related disturbance (traffic management, noise and visual impacts acting in combination) and change in footfall and visitor numbers;
- temporary changes in access to businesses resulting from traffic management measures and traffic diversions during construction, and permanent changes in access during operation;

- changes in traffic flows through Dunkeld, Birnam and Inver during construction and during operation;
- changes in footfall and visitor numbers during construction (resulting from the traffic management, noise and visual impacts acting in combination) and changes in footfall and visitor numbers during operation; and
- loss of, and potential replacement, of tourism and business signage.

8.2.36 The key considerations in paragraph 8.2.35 were used to assess how the proposed route options fulfil economy related community objectives or are contrary to economy-related community objectives, using a combination of consultation feedback and professional judgement. These community objectives were identified during the A9 Co-Creative Process and as described in full in Volume 1, Part 1 - The Scheme, Section 1.8 (A9 Co-Creative Process)) of this report. The economy related community objectives have been identified as:

- Promote long-term and sustainable economic growth within Dunkeld and Birnam and the surrounding communities.
- Preserve and enhance the integrity of the unique and rich historical and cultural features of the Dunkeld, Birnam and Inver communities, thereby supporting well-being and the local economy.

Community Assets

8.2.37 The assessment of impacts and effects on community assets followed the same approach as detailed for the assessment of land-take and vehicle access on private property and businesses, as described in paragraphs 8.2.19 to 8.2.34.

Community Land

8.2.38 The assessment of impacts and effects on community land followed the same approach as detailed for the assessment of land-take and vehicle access on private property & housing and businesses, as described in paragraphs 8.2.19 to 8.2.34.

Development Land

8.2.39 DMRB LA 112 treats development land and businesses as one category of land use to be assessed together. For the purposes of this report, they are separated into different land use categories and assessed separately with development land encompassing land allocated for development and planning applications and businesses encompassing commercial businesses utilising land and/or property. This separation provides opportunity for clearer differentiation of potential effects on development land and businesses whilst still complying with DMRB LA 112 guidance. DMRB LA 112 provides criteria for the assessment of land allocated for housing and land allocated for employment. If a site is allocated within the Local Development Plan for a mixture of uses such as housing and employment, or the planning application provides for a mix of such uses, a review of the land use composition of the site would be undertaken and land use effects would be assessed using sensitivity and magnitude criteria for the most prevalent land use.

Sensitivity

8.2.40 Table 8.2 provides details on the criteria for assessing the sensitivity of private property & housing and these are also applicable to development land allocated for housing. Table 8.5 provides details of the criteria for assessing the sensitivity of other development land allocated for employment use.

Table 8.5: Sensitivity criteria for land allocated for employment

Receptor value (Sensitivity)	Criteria
Very High/High	Land allocated for employment covering >1ha.
Medium	Land allocated for employment covering <1 ha.
Low	Proposed development on unallocated sites providing employment with planning permission/in the planning process.
Negligible	N/A

Magnitude of Impact

8.2.41 Development land allocations that do not have planning permission are assessed and reported based on the land use it is allocated for, in addition to its existing land use to reflect impacts on current land use. Where a development land allocation is the subject of a pending planning application the assessment reports impacts on both existing land use and on the future use as proposed by the planning application.

8.2.42 The magnitude criteria of impacts arising from land-take and change in accessibility for land allocated for both housing and employment (business) and similarly for planning applications are detailed in Table 8.3. However, it should be noted that due to uncertainty of the final planned built form and the level of detail available for development land and planning applications, professional judgement has been used in the determining magnitude of impacts for receptors.

Significance of Effect

8.2.43 The significance of effect was determined taking into account sensitivity and magnitude, as set out in Table 8.4.

Agricultural Land Holdings

8.2.44 For agricultural land holdings, the assessment considered the potential impacts and effects of the following:

- land-take in relation to the quantity and quality of agricultural, forestry and sporting land and loss of key infrastructure;
- type of land use or sporting activity affected (arable, mixed agriculture, improved grassland, rough grazing, woodland, shooting, stalking and fishing);
- spatial relationship of land to key infrastructure and introduction or removal of severance, including the number of fields or land/forestry parcels affected; and
- the need for and likely effects of specific mitigation for access, drainage and water supply beyond that which are currently embedded in the proposed route option designs and that would be developed during the DMRB Stage 3 assessment.

8.2.45 The LCA data were used to determine the land use and quality of agricultural land, and Phase 1 Habitat survey data were used to determine the character of woodland and forestry. These data also informed consideration of the shooting and stalking potential within the study area. In the case of fishing, Tay District Salmon Fisheries Board and fishing proprietors' resources were used to identify the scope and quality of fishing in the study area.

8.2.46 At DMRB Stage 2, the details of how farmers take access to their fields, farm buildings and key infrastructure are not fully known and therefore access is assessed in general terms only. Where potential

loss of direct access onto the A9 is identified, this is assessed. In addition, the number of fields where land-take would occur is used as a measure of likely severance; disruption to access; and disturbance to boundary features, land drainage systems and livestock watering points in fields. A more detailed assessment of the need for and likely impacts of major accommodation works for access, drainage and water supply and consequently the level of disturbance to farming operations would be undertaken as part of the DMRB Stage 3 assessment.

8.2.47 The assessment of effects on agricultural land holdings has been undertaken by determining the sensitivity and magnitude according to the criteria in Table 8.6 and Table 8.7. The significance of effect was determined using Table 8.4.

8.2.48 Sensitivity criteria have been developed based on LCA class, agricultural land use category, scope of commercial sporting activity and amenity and commercial value of woodland. A sensitivity rating was assigned for each land interest using professional judgement and reflecting the range of land quality and land use activities on the holding.

Table 8.6: Agricultural Land Holdings Sensitivity Criteria

Sensitivity	Criteria
Very High/High	▪ Presence of prime quality land (LCA Class 1, 2 and 3.1) and land use with high production intensity. Land which is dependent on the spatial relationship to key infrastructure and where access is required frequently. ▪ Presence of high value woodland that is rare or distinctive and susceptible to small changes. ▪ Land, woodland and water that supports high value commercial sporting activity (e.g. salmon fishing, grouse shooting).
Medium	▪ Presence of non-prime land of moderate quality (LCA Class 3.2 to 4.2) and land use with moderate production intensity. Land which is partially dependent on the spatial relationship to key infrastructure and where access is required reasonably frequently. ▪ Presence of moderate value woodland tolerant to moderate levels of change. ▪ Land, woodland and water that supports moderate value commercial sporting activity (e.g. pheasant shooting).
Low	▪ Presence of non-prime land of low quality (LCA Class 5 to 7) and land use with low production intensity. Land which is not dependent on the spatial relationship to key infrastructure and where access is required infrequently. ▪ More commonplace woodland tolerant of noticeable change. ▪ Land, woodland and water that's supporting low value sporting activity (e.g. rough shooting).
Negligible	▪ Land infrequently used on a non-commercial basis.

8.2.49 The magnitude of impact criteria in Table 8.7 have been set on the understanding that the average size of a commercial farm in the area is around 337ha (agricultural land and woodland) and as such a low magnitude of impact in relation to land-take would represent up to 2.5% of the total holding and a high magnitude of impact would represent more than 7.5% of the total holding (interpreted from information contained within Economic Report on Scottish Agriculture Tables - 2020 Edition (Scottish Government, 2020c) for holdings greater than 20ha in size).

8.2.50 Refer to paragraph 8.2.20 for the effect of rounding when reporting total land-take and land-take by LCA Class.

8.2.51 Magnitude of impact criteria take into account operational impacts on agriculture such as field fragmentation, changes in existing access, disruption to land drainage systems, loss of boundary features and disturbance to livestock watering arrangements. In the case of forestry, the magnitude criteria take into account operational impacts on forestry management and harvesting. Magnitude of impact criteria

for sporting impacts reflect the range in commercial value of different activities from rough shooting to grouse shooting/deer stalking and from trout/grayling fishing to salmon fishing.

Table 8.7: Agricultural Land Holdings Magnitude of Impact

Impact	Criteria
Major	Loss of resource and/or quality and integrity of resource, severe damage to key characteristics, features or elements. For example, where there is a combination of: ▪ high levels of disruption to access assuming existing access is stopped up and alternative access is provided; ▪ direct acquisition and demolition of key infrastructure; ▪ permanent land-take greater than 7.5% of average size holding (25.28ha per holding); and ▪ major severance and/or other operational impacts to current agricultural, forestry and sporting systems and practices that may compromise overall viability.
Moderate	Partial loss/damage to key characteristics, features or elements. For example, where there is a combination of: ▪ moderate levels of disruption to access assuming existing access is stopped up and alternative access is provided; ▪ permanent land-take greater than 2.5% of average size holding (8.43ha per holding) but less than 7.5% (25.28ha); and ▪ moderate severance and/or other operational impacts to current agricultural, forestry and sporting systems and practices that would not compromise overall viability.
Minor	A discernible change in attributes, quality or vulnerability; minor loss of, or alteration to one (maybe more) key characteristics, features or elements. For example, where there is a combination of: ▪ minor levels of disruption to access assuming existing access is stopped up and alternative access is provided; ▪ permanent land-take of less than or equal to 2.5% of average size holding (less than 8.43ha per holding); and ▪ minor severance and/or other operational impacts to current agricultural, forestry and sporting systems and practices not directly affecting viability.
Negligible	Very minor loss or detrimental alteration to agricultural holding operations.
No change	No loss or alteration of characteristics, features, elements or accessibility; no observable impact in either direction.

8.2.52 Significance of effect was determined taking into account sensitivity and magnitude as set out in Table 8.4. Effects identified to be Moderate or above are generally considered to be significant in the context of this DMRB Stage 2 assessment.

Community Objectives

8.2.53 At an early stage in the A9 Co-Creative Process, the Birnam to Ballinluig A9 Community Group generated community objectives. The seven objectives are presented in Volume 1, Part 3 - Environmental Assessment (Chapter 7: Overview of Environmental Assessment) and cover a wide range of topics but focus predominantly on environmental issues.

8.2.54 The community objectives have been taken into consideration throughout the DMRB Stage 2 process and a mapping exercise was conducted to indicate how, in the operational phase, the proposed route options could contribute to the relevant objectives. Details of how each environmental topic contributes towards achieving the community objectives is presented in *Appendix A7.1: Mapping of Community Objectives Against DMRB Stage 2 Route Options* and a summary for this chapter is presented in Section 8.6 (Summary of Route Options Assessment).

Limitations to Assessment

8.2.55 It should be noted that this DMRB Stage 2 assessment was prepared prior to and during the global COVID-19 coronavirus pandemic. Throughout 2020 and in early 2021, there have been significant and extensive restrictions in place in Scotland on the movement of people and the activities that are permitted. Due to the duration and extent of such restrictions, some of the baseline and survey updates have not been achievable.

8.2.56 Land-take calculations used in the assessment are approximate and are based on the footprint of the proposed route options, including a buffer where appropriate and land required for construction (refer to paragraph 8.2.19). The calculations do not include any additional land-take required for aspects such as landscape planting or ecological mitigation as these would be identified during the DMRB Stage 3 assessment.

8.2.57 Community land is defined in paragraph 8.1.2. However, as noted in Volume 1, Part 3 - Environmental Assessment (Chapter 17: Population - Accessibility) of this assessment, the Land Reform (Scotland) Act 2003 establishes statutory rights of responsible access on and over most land. It is therefore acknowledged that additional areas of privately-owned land may be used informally by the community. These would be identified through further consultation during the DMRB Stage 3 assessment, with mitigation proposed as necessary.

8.2.58 The above limitations are typical of a DMRB Stage 2 assessment, and the assessment reported in this chapter is considered robust and of an appropriate level to provide an assessment of each of the proposed route options including a comparative assessment.

8.3 Baseline Conditions

Socio-economic context

8.3.1 The Scottish Index of Multiple Deprivation (SIMD) identifies areas of multiple deprivation across all of Scotland and ranks these areas from most deprived (ranked 1) to least deprived (ranked 6,976). None of the communities identified within the study area are listed in the top 20% of multiple deprivation (Scottish Government, 2020b).

8.3.2 Dunkeld and Birnam are located across two data zones within the SIMD Decile of 'Luncarty and Dunkeld'. SIMD statistics show that these areas are considered to be among the 7th and 6th least deprived areas in Scotland, coming in at 4,777 and 4,000 out of 6,976 Local Authority jurisdictions. This ranking is derived from similar ratings in areas such as 'Income', 'Employment', 'Health', 'Education', and 'Housing' and shown for both data zones in Table 8.8 (SIMD, 2020b).

Table 8.8: SIMD (2020) ratings for 'Luncarty and Dunkeld' decile

Data Zone	Rank							
	Overall	Income	Employment	Health	Education	Housing	Geographical Access	Crime
S01012007	7th	6th	7th	7th	8th	7th	4th	10th
S01012008	6th	7th	6th	8th	8th	5th	2nd	7th

8.3.3 In the 2011 census, the population of the local area in the settlement of Dunkeld and Birnam was 1,287, accounting for approximately 0.8% of the wider population of Perth and Kinross (146,652). According to the 2011 census, much of the population within the settlement of Dunkeld and Birnam consisted of the age cohort of 45 years or over (55%) with a mean age of 46, suggesting an aging population. This compares to 44% in the age cohort of 45 years or over for Scotland and a mean age of 40. Approximately

29% of the population in the settlement of Dunkeld and Birnam were aged between 16-44 years compared to 39% for Scotland as a whole (Scotland's Census, 2011).

Local Communities

8.3.4 The main communities within the study area are Birnam, Little Dunkeld, Dunkeld and Inver. The location of these communities is shown on Diagram 8.1 and, in relation to the proposed route options, on Figures 8.1 to 8.4.

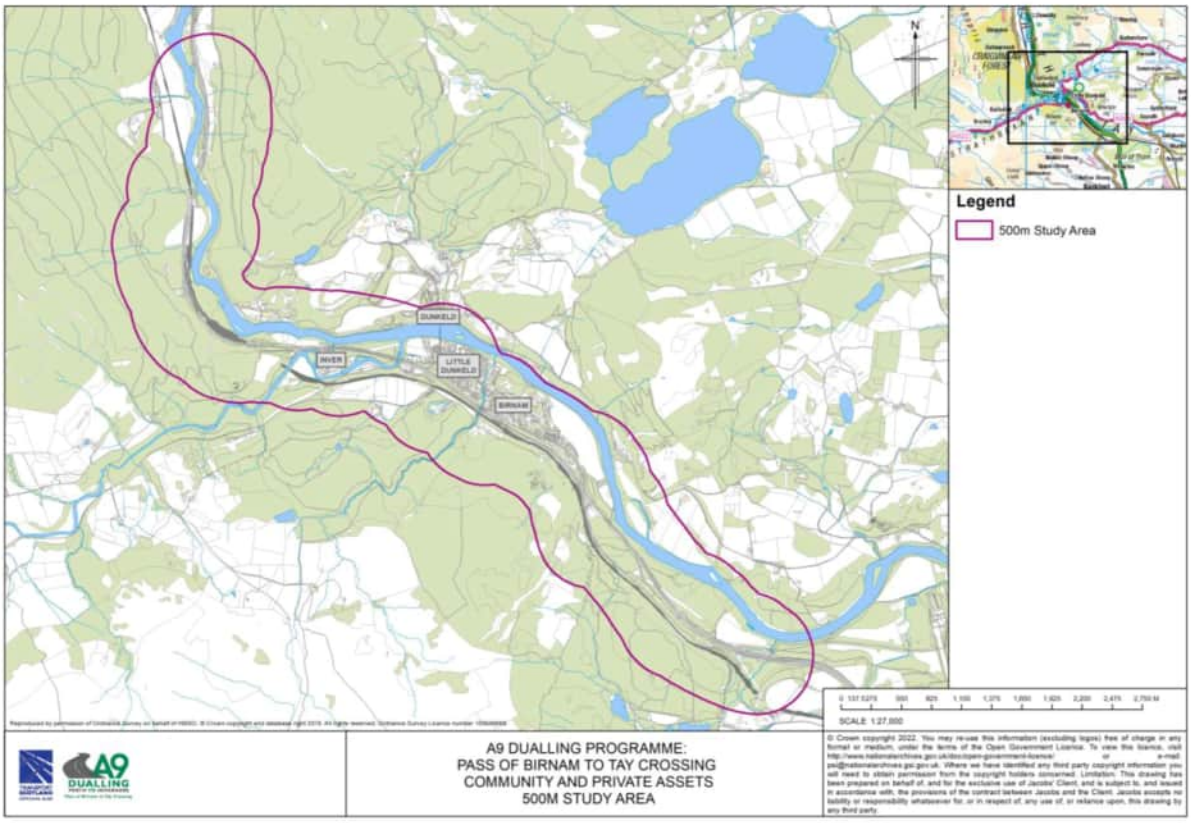

Diagram 8.1: Local Communities and study area (Option ST2A only), Ordnance Survey

Private Property & Housing and Businesses

Private Property & Housing

8.3.5 Most residential properties are located within the communities referred to in paragraph 8.3.4, with the remainder made up of scattered rural dwellings, including a number of farmhouses and their associated cottages. It is estimated that there are 607 dwellings within Dunkeld and Birnam (Scotland's Census, 2011).

8.3.6 Based on the criteria detailed in Table 8.2 sensitivity ratings for residential areas and individual properties have been allocated as follows:

- Byres of Murthly: medium sensitivity;
- Murthly Castle Estate: medium sensitivity;
- Ringwood: medium sensitivity;
- Birnam: very high/high sensitivity;
- Dunkeld: very high/high sensitivity;

- Little Dunkeld: very high/high sensitivity;
- Inver: very high/high sensitivity;
- Birnam Glen: medium sensitivity; and
- Properties on the B898: medium sensitivity.

8.3.7 Auchlou Cottage, which is located adjacent to the southbound carriageway of the existing A9, has been assigned a sensitivity of low as the property is permanently unoccupied.

Businesses

8.3.8 Published statistics data (Office for National Statistics, 2018) have been interrogated to illustrate the different types of businesses within Perth and Kinross and Scotland and is presented on Diagram 8.2. These data show that compared with Scotland as a whole, Perth and Kinross has a larger rate of non-manufacturing production businesses, likely to be farms and a lower rate in the professional, scientific and technical sector. The data also available for Dunkeld and Birnam are more restricted but do highlight a narrower range of businesses including the presence of businesses within the categories of accommodation and food services and retail, wholesale and repairs businesses.

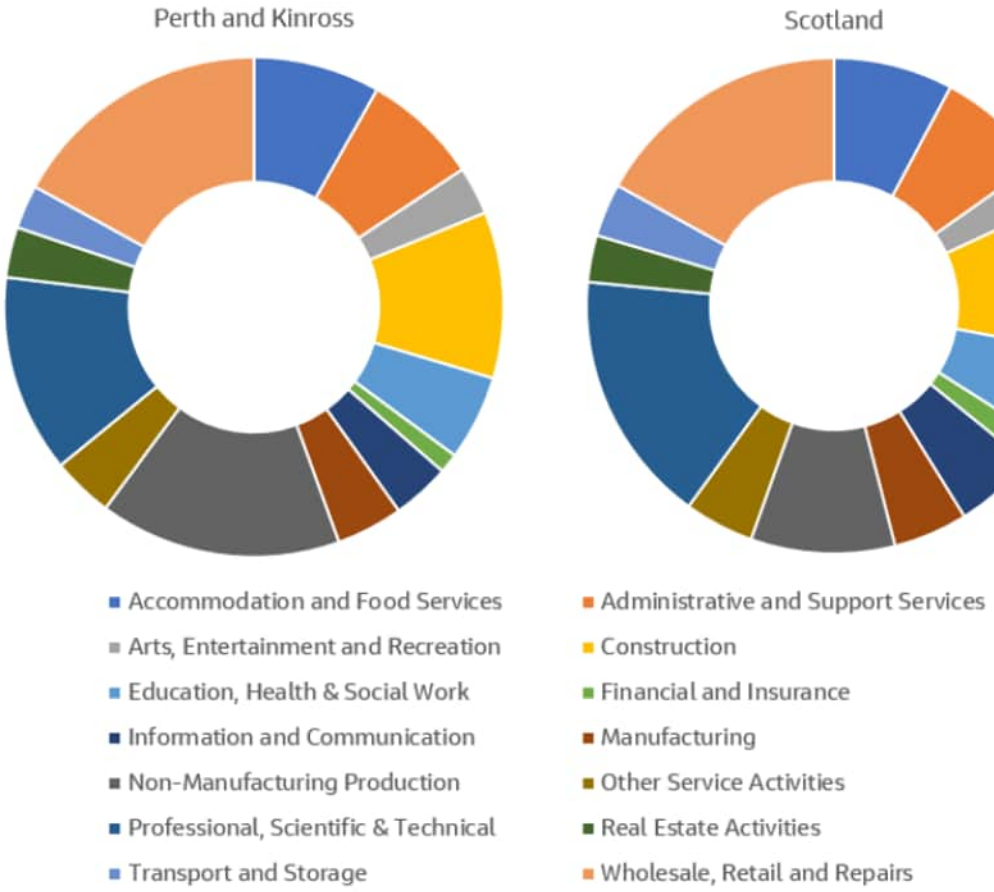

Diagram 8.2: Business profile in a local and national context (Office for National Statistics, 2018)

8.3.9 Businesses within the study area have been identified and summarised within Table 8.9 using the resources outlined in paragraphs 8.2.12 and 8.2.17. *Appendix A8.1: Business Properties* provides a breakdown of all businesses identified within the study area and the locations of the identified businesses are illustrated on Figures 8.1 to 8.4.

Table 8.9: Business profile within the study area

Business classification	No. of sites	% of total sites
Accommodation	25	28
Commercial/Industrial	6	7
Education	1	1
Financial	1	1
Motor Vehicle Retail, Repair and Hire	2	2
Office/Workshop	15	17
Petrol Filling Station	1	1
Restaurant/Cafeteria	10	11
Retail/Showroom	27	30
Waste Transfer/Disposal	1	1

8.3.10 There is a total of 89 businesses within the study area. The majority of accommodation, restaurants/cafeterias and retail /showroom businesses are located within the centres of Dunkeld and Birnam. Most industrial businesses are located within the surrounding area, including Inver and south of Birnam. Other businesses include hairdressers, dental practices and taxi services. Further details on these businesses are included in *Appendix A8.1: Business Properties*.

8.3.11 Gross Disposable Household Income (GDHI), which is the amount of money that all of the individuals in the household sector have available for spending or saving after income distribution measures, has grown by 17.5% in Perth and Kinross and Stirling, and by 17.7% in Scotland over the last 10 years (refer to Table 8.10). This illustrates that residents of Dunkeld and Birnam have disposable income available for spending in local business sectors such as food retail and arts.

Table 8.10: GDHI per head in local and national context (ONS, 2018)

	GDHI per head (£) and Growth in GDHI (%)									
Location	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
Perth & Kinross and Stirling	17,024 2.1	17,068 0.9	17,026 0.7	17,928 6.2	18,414 3.4	18,823 2.3	18,928 1.2	19,425 3.6	19,530 1.2	20,013 2.8
Scotland	15,373 4.9	15,601 2.1	15,712 1.3	16,045 2.8	16,692 3.9	17,109 3.2	17,382 2.0	17,916 3.6	17,942 0.7	18,099 1.3

8.3.12 Employment and unemployment rates in Perth and Kinross and Scotland are shown in Table 8.11. The dominant occupation in Perth and Kinross is 'wholesale and retail trade and repair of motor vehicles and motorcycles' at 16.7% followed by 'human health and social work activities' at 13.3% (Nomis, 2018).

Table 8.11: Employment and unemployment rates in local and national context (Nomis, 2018)

	Perth and Kinross (numbers)	Perth and Kinross (%)	Scotland (%)
Economically Active	81,600	85.7	77.8
In Employment	78,900	82.6	74.8
Employees	63,700	68.7	65.7
Self-employed	14,800	13.8	8.8
Unemployed	2,200	2.7	3.9

8.3.13 Employment and unemployment trends over the 12-year period 2006 to 2017 in Peth & Kinross and Scotland are shown in Diagrams 8.3 to 8.5.

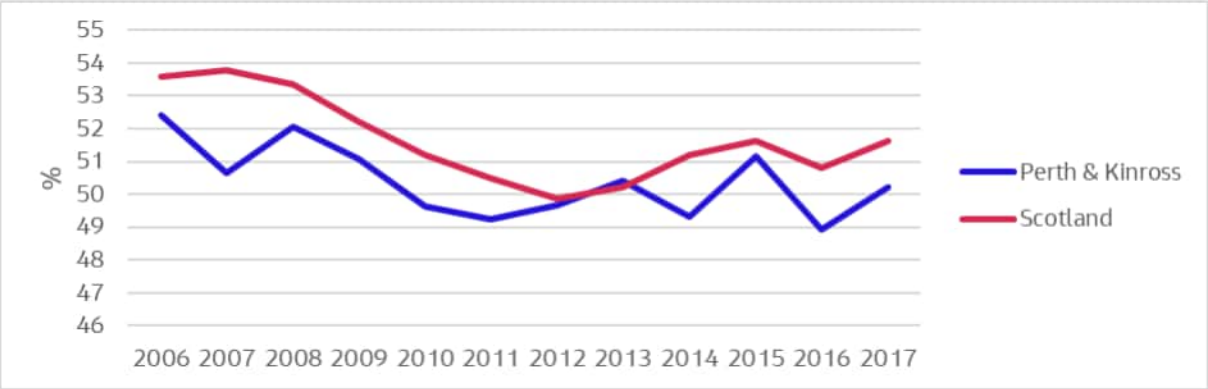

Diagram 8.3: Employee trend from 2007 to 2016 in local and national context (Nomis, 2018)

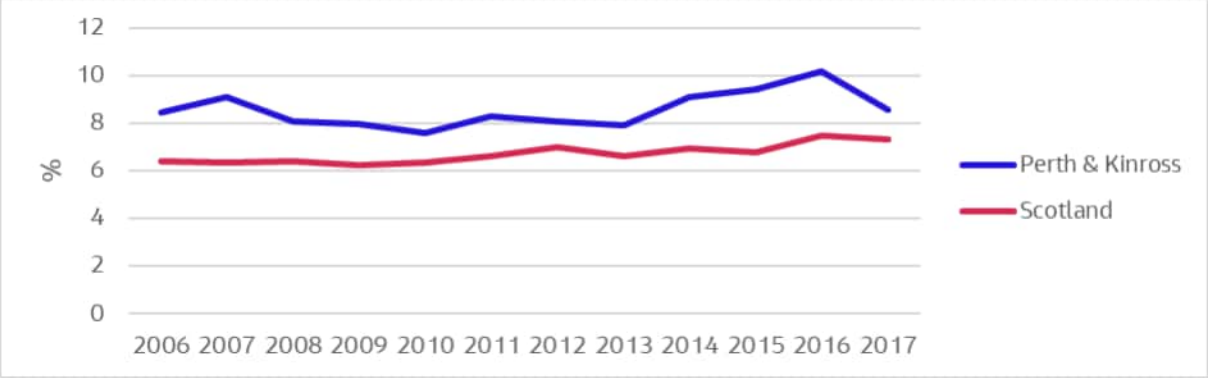

Diagram 8.4: Self-employed trend from 2007 to 2016 in local and national context (Nomis, 2018)

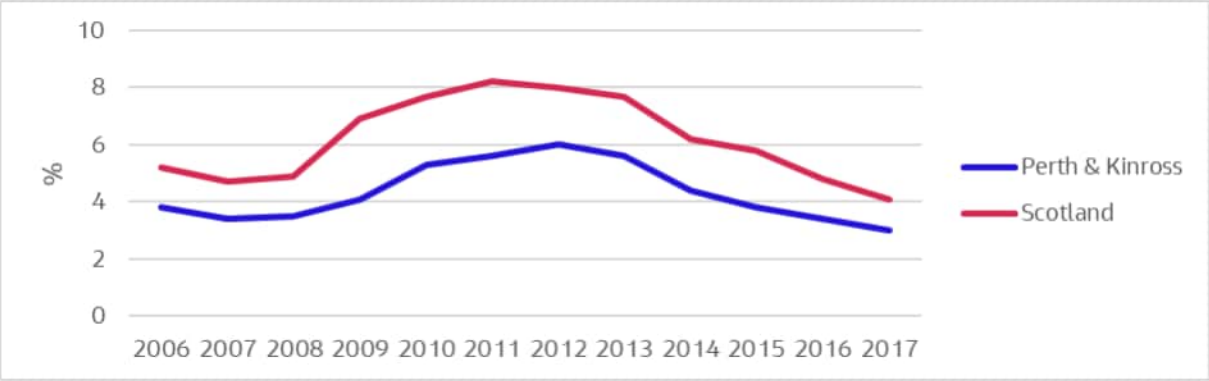

Diagram 8.5: Unemployed trend from 2007 to 2016 in local and national context (Nomis, 2018)

8.3.14 Diagram 8.3 shows an overall decline in employee numbers from 2006 to 2011 however, since 2011 this has begun to increase, with some fluctuations. Diagram 8.4 shows that there are more self-employed within Perth and Kinross in comparison with Scotland. The number of unemployed is lower in Perth and Kinross in comparison with Scotland, however the trend of an increase to 2011 to 2012 and then decrease from 2012 is the same. The 2011 Census data identify that within the 607 households in Dunkeld and Birnam, 223 adults were not in employment and of these, 220 were without dependent children.

8.3.15 Table 8.12 summarises government statistics on what mode of transport people usually use to get to work and education, as well as the percentage of total journeys which people make for a given purpose. The table indicates that people in Perth and Kinross are more likely to walk or take a bus to work illustrating that employees of local businesses would also often live locally and the importance of public transport where commuting to work is required. The purpose of people's journeys in Perth and Kinross for shopping and business are larger than Scotland, but less than for health and education.

Table 8.12: Modes of transport to work and other purposes in local and national context (Statistics, 2018)

Modes of Transport	Perth and Kinross (%)	Scotland (%)
Bus journeys to work	14.7	10.4
Business journeys	3.4	1.9
Child journeys to school by walking/cycling	50.9	53.2
Commuting journeys	17.7	23.4
Cycling journeys to work	1	2.6
Education journeys	3.9	6.6
Health journeys	0.9	2.1
Shopping journeys	29.8	23.4
Train journeys to work	0.5	5.2
Walking journeys to work	21.6	12.3

Tourism and Recreation

8.3.16 Within the wider region, tourism is of growing importance. The existing A9 provides access between Perth and Inverness and is a conduit for travellers looking to visit different regions of Scotland. Although overnight visits to Perth and Kinross dropped by 6% in 2018, the total number of trips increased by 4% on average per year between 2015-2017 to 2016-2018. This is mainly caused by an increase in day visits which accounts for 88% of total visits to Perth and Kinross and approximately half of the spend.

The volume and value of international tourism to Perth and Kinross declined in 2016-2018 by 13% less trips and 13% less money, however this was mainly offset by a big increase in Scottish residents' tourism which grew by over a quarter from 2015-2017 to 2016-2018. Net tourism expenditure declined by 2% between 2015-2017 to 2016-2018. A summary of tourism is provided in Table 8.13.

Table 8.13: 2018 Tourism Summary (Visit Scotland, 2019)

Location	Visits	Nights	Spend
International Visits			
Perth and Kinross	85,000	263,000	£25M
Scotland	3,538,000	24,237,000	£2.206Bn
Domestic Visits			
Perth and Kinross	699,000	2,287,000	£170M
Scotland	11,803,000	40,331,000	£2.762Bn

8.3.17 Tourist attractions within the study area have been identified through the resources outlined in paragraph 8.2.12 and 8.2.17. Within Dunkeld and Birnam there are several tourist attractions that offer sporting activities such as Progression Bikes, County Clays, The Canyoning Company and Paddle Surf Scotland. The Hermitage, located west of Inver, is owned by the National Trust for Scotland and offers scenic woodland walks, nature spotting and guided tours. Dunkeld and Birnam also hold The Annual Niel Gow Festival which includes a variety of concerts, recitals and workshops. These events are accommodated in several locations in the town including The Royal Dunkeld Hotel, Little Dunkeld Church and the Birnam Arts and Conference Centre.

8.3.18 The PKC LDP 2 (PKC, 2019) seeks to enhance existing tourism facilities, which includes Inver Mill Farm Caravan Park due to its contribution to visitor accommodation in the area. The retention of this facility is important for the local community and is included within the PKC LDP 2 as a tourism policy (Policy 9A – Caravan Sites, Chalets and Timeshare Developments: Existing Caravan Sites). Further information is provided within the 'Development Land and Planning Applications' section of this chapter.

8.3.19 Within the study area there are 25 properties classified as 'accommodation' such as hotels, guesthouses, bed and breakfasts and self-catering accommodation. These include facilities such as the Dunkeld House Hotel and the Inver Mill Farm Caravan Park providing a diverse range of accommodation options to visitors and tourists. A further ten properties are classified as 'restaurant/cafeteria' and provide a range of dining options including cafés and bistros.

8.3.20 In accordance with the criteria for assessing the sensitivity of businesses in Table 8.2, all businesses within the study area are allocated a sensitivity of medium, with the exception of the following businesses:

- Network Rail Infrastructure Ltd: very high/high sensitivity;
- Ladywell Landfill: very high/high sensitivity;
- Aran Bakery: very high/high sensitivity;
- Birnam Industrial Estate (including Lonely Mountain Skis, Merriman Joinery, Dunkeld Plumbers and T&M Developments): very high/high sensitivity; and,
- Substation site by Birnam Industrial Estate: very high/high sensitivity.

Community Assets

8.3.21 The majority of community assets are located within Birnam, Little Dunkeld and Dunkeld. Community assets within the study area include village halls, healthcare facilities, postal services, education facilities

and religious facilities. Table 8.14 outlines the community assets identified in the study area, and the assigned sensitivities in accordance with Table 8.2.

Table 8.14 Community assets within 500m study area

Community Asset	Sensitivity
St Columba's Church	Very High/High
Birnam Arts and Conference Centre (art centre, community centre, library, conference centre, Beatrix Potter Exhibition and café)	Very High/High
Dunkeld and Birnam Recreation Club (outdoor recreation centre comprising two all-weather tennis courts, bowling green and a grass football pitch) and designated as Open Space	Very High/High
Royal School of Dunkeld (nursery and primary school and community education/adult education base)	Very High/High
Rivendell Residential Home	Very High/High
Craigvinean Surgery	Very High/High
St Mary's Episcopal Church	Very High/High
Little Dunkeld Kirk	Very High/High
Little Dunkeld Village Hall	Very High/High
Dunkeld Dental Surgery	Very High/High
Infinityblu Dental	Very High/High
Dunkeld Cathedral	Very High/High
The Duchess Anne Hall	Very High/High
The Chanonry Hall	Very High/High
The Drill Hall (army training facility)	Very High/High
Dunkeld & Birnam Station	Very High/High
Dunkeld Post Office	Very High/High
Birnam Post Office	Very High/High
Fire Station (a retained volunteer service)	Very High/High
10 Bus Stops (2 at Inver, 8 in Little Dunkeld and Birnam)	Very High/High

8.3.22 Community assets are shown along the proposed route options on Figure 8.5.

Photograph 8.1: Dunkeld and Birnam Recreation Club

Community Land

8.3.23 The PKC LDP 2 identifies Sports Pitches, Parks and Open Space which have value to the community for either recreational or amenity purposes (PKC, 2019). Policy 14 (Open Space Retention and Provision) and accompanying supplementary guidance 'Open Space Provision for New Developments' provides the policy framework for development in respect of Open Space and is outlined in Table 8.15. Areas designated as Open Space (LA02) are shown on Figure 8.5 and include but are not limited to: Riverside Land (National Trust for Scotland); Dunkeld and Birnam Recreation Club (Community Asset); Birnam Highland Games Park (Church of Scotland land by Little Dunkeld Manse); Riverside Play Area; Jubilee Park; Birnam Play Area; and, Little Dunkeld Recreation Park. The locations of these areas of community land are shown on Figure 8.5.

8.3.24 Areas of open space within the study area are allocated a medium sensitivity given the balance of existing accessibility provision, the frequency of use and level of use by the community and the availability of alternative facilities at a local level.

8.3.25 Other land identified as being potentially used by the community for recreation or amenity purposes but not designated as Open Space in the PKC LDP 2 includes:

- Torwood Park: medium sensitivity;
- Open Amenity Ground at Inchewan Burn: medium sensitivity;
- St Ninian's Wynd Gardens: medium sensitivity; and
- The Hermitage (National Trust for Scotland visitor attraction): very high/high sensitivity.

8.3.26 The majority of community land is located within Birnam, Little Dunkeld and Dunkeld. The Hermitage is a National Trust for Scotland owned visitor attraction located north of Inver. The location of these areas of community land are also shown on Figure 8.5.

Table 8.15: Open Space Policy Framework in the Perth & Kinross Local Development Plan 2 (Pass of Birnam to Tay Crossing)

Ref	Type/Name	Overview
Community Facilities, Sport and Recreation		
Policy 14: Open Space Retention and Provision		
Policy 14A (LA02)	Existing Areas	Areas of open space, parks, outdoor sport facilities, including sport pitches, and allotments/community growing areas, are areas of land which have value to the community for either recreational or amenity purposes; these areas are located both within and outside settlement boundaries. Development proposals resulting in the loss of these areas will not be permitted, except in circumstances where one or more of the following apply: a) Where the site is principally used as a recreation resource, the proposed development is ancillary to the principal use of the site as a recreational resource. b) The proposed development involves a minor part of the site which would not affect its continued use as a recreational or amenity resource. c) In the case of proposals involving the loss of a recreational facility, the facility which would be lost would be replaced by provision of one of comparable or greater benefit and in a location which is convenient for its users, or by the upgrading of an existing provision to provide a better quality facility, either within the same site, or at another location which is convenient for its users. d) Where a proposal would involve the loss of a sports pitch, a playing field strategy prepared in consultation with sportscotland has demonstrated that there is a clear excess of sports pitches to meet current and anticipated future demand in the area, and that the site could be developed without detriment to the overall quality of provision.
Policy 14B (LA02)	Open Space within New Developments	The Council will seek the provision of appropriate areas of informal and formal open space that is accessible to all users as an integral part of any new development where existing provision is not adequate. Allotments should be incorporated where there is a proven demand in the local area. The Council will also encourage opportunities for the provision of community growing spaces as part of new developments where appropriate. Where it is physically impossible or inappropriate to meet the open space provision on-site, consideration may be given to the provision of a suitable alternative. In areas where there is an adequate supply of accessible open space of an appropriate quality in a locality, a financial contribution towards improvement or management of existing open space may be considered an acceptable alternative.

8.3.27 There are a number of footpaths (e.g. core paths) within the study area that provide access for the public and may be used by the local community for recreational purposes. The potential impact and effects of the proposed route options on these paths is considered within Volume 1, Part 3 - Environmental Assessment (Chapter 17: Population - Accessibility) of this assessment.

8.3.28 Murthly Castle, Dunkeld House and The Hermitage are all situated within the study area and are recorded on Historic Environment Scotland's Inventory of Gardens and Designed Landscapes in Scotland (Historic Environment Scotland, 2015a; 2015b; 2015c). Potential impacts and effects on Murthly Castle, Dunkeld House and The Hermitage are also assessed in Volume 1, Part 3 - Environmental Assessment (Chapter 12: Landscape, Chapter 13: Visual and Chapter 14: Cultural Heritage). The study area also encompasses Dunkeld War Memorial and potential impacts on this receptor are also reported in Volume 1, Part 3 - Environmental Assessment (Chapter 14: Cultural Heritage).

Development Land

8.3.29 There are seventeen planning applications and four development land allocations within the study area.

8.3.30 In relation to development land, PKC LDP2 allocates land to be safeguarded for existing uses with corresponding LDP policies detailing requirements for further development (e.g. Policy 7 - Employment and Mixed Use Areas). Land allocations and their respective PKC LDP2 policies are outlined in Table 8.16. Where such land allocations relate to an existing use the assessment of impacts and effects is reported in the relevant land use sections, for example Open Space.

8.3.31 As explained within paragraph 8.2.16 consultation has taken place to identify planning permissions granted between 01 October 2018 and valid up to 01 October 2021. Applications submitted during this period, but are under consideration, have also been included within the assessment. Each planning application is assigned a reference for the purpose of this assessment (e.g. PA01: Planning Application) and are outlined in Table 8.17.

8.3.32 Although land has been safeguarded by Policy 54 (Health and Consultation Zones), it is not of relevance to the assessment of the proposed scheme as it concerns health and safety considerations of planning applications as detailed in Table 8.16.

8.3.33 The TAYplan Strategic Development Plan (TAYplan, 2017) sets out land use planning policies to guide development from 2016-2036 across Dundee, Angus, Perth and North Fife. Under Policy 1: Location Priorities, Dunkeld/Birnam is categorised as a Tier 3 settlement which has the potential to play an important but more modest role in the regional economy and will accommodate a small share of the region's additional development.

8.3.34 Planning policy, land allocations and extant planning applications relevant to the proposed scheme are outlined in Table 8.16 and Table 8.17, with their location shown on Figure 8.5 (Community Facilities, Community Land, Development Land and Planning Applications).

Table 8.16: Planning Policy and Development Land Allocations

Ref	Type/Name	Overview
PKC LDP 2: Tourism policy		
Policy 9A (LA03)	Existing Caravan Sites	Encouragement will be given to the retention and improvement of existing caravan and camping sites for holiday-related uses provided the improvements are compatible with adjoining land uses and the site makes a positive contribution to the local economy.
Policy 9B (LA03)	New or Expanded Transit and Touring Caravan, motorhome/Campervan and Camping Sites	Proposals for new or expanded sites for holiday-related uses will be supported where the proposals are compatible with Policy 1.
Policy 9C (LA03)	Chalets, Timeshare and Fractional Ownership	The Council will give favourable consideration to new chalet and timeshare/fractional ownership developments where it is clear these cannot be used as permanent residences. Such developments must also: a) involve the expansion of an existing hotel, guest house, chalet park, caravan park or timeshare or fractional ownership development where the development does not constitute either overdevelopment of the site or its setting; or b) replace static caravans with more permanent structures; or c) meet a specific need by virtue of its quality or location in relation to existing tourism facilities.

Ref	Type/Name	Overview
PKC LDP 2: Economic Development policy		
Policy 7 (LA01)	Employment and Mixed Use Areas	Any proposed development must be compatible with surrounding land sues. In addition, all the following criteria will be applied to development proposals in these areas (individual sites may also have specific requirements): a) Proposals should not detract from the amenity of adjoining, especially residential, areas. b) The local road network and connections to the national road network must be suitable for the traffic generated by the proposals. c) There should be good walking, cycling and public transport links to new employment generating uses. d) Proposals for retail uses in employment areas will not be acceptable unless they are ancillary to an acceptable use on the site. e) Proposals for service facilities (should exclude retail and commercial facilities over 100m^2) and should serve the business and industrial area rather than draw outside trade and cumulatively should not equal more than 15% of the allocated employment area. f) Proposals for waste management facilities can be considered to be acceptable subject to detailed site-specific considerations. g) Proposals should not result in adverse impacts, either individually or in combination, on the integrity of any European designated site. Applications shall be supported by sufficient information to allow the Council to conclude that there would be no such adverse effects. Areas identified as core business and industrial land should be retained for Class 4,5 and 6 uses (unless criteria (d), (e) or (f) of 7A apply). For areas identified as general business and industrial areas with potential for mixed uses, the preference remains to protect these areas for Class 4,5 and 6 uses. However, proposals outwith these classes (but excluding residential or retail that is principally for visiting members of the public) will be considered with regard to: (a) impact on local availability of serviced land and buildings for business, industry or storage and distribution uses; (b) the degree to which these types of uses are already present in the locality; (c) the availability of other locations for the proposed use (for Class 2 and leisure uses any proposal must meet the sequential test, and proof through a sequential assessment report is required).
PKC LDP 2: Building Resilience Policy		
Policy 54 (LA04)	Health and Safety Consultation Zones	In determining planning applications for development within the Pipeline Consultation Zones identified on the proposals, inset maps and Appendix 3, the Council will seek and take full account of the advice from the Health and Safety Executive and the facility's operators and owners. The Council will also seek the advice of the Health and Safety Executive and the facility's operators and owners on the suitability of any proposals for a new notifiable installation within the Plan area or any proposal within the consultation zone of any other notifiable installation.
TAYplan Strategic Policy		
Policy 1	Location Priorities	Strategies, plans, programmes and development proposals shall: A. focus the majority of development in the region's principal settlements – Dunkeld/Birnam is a Tier 3 settlement with an important but more modest role to play in the regional economy and will accommodate a small share of the region's additional development which is more about sustaining them; and B. prioritise land release for all principal settlements using the sequential approach in this Policy; and prioritise within each category, as appropriate, the reuse of previously developed land and buildings (particularly listed buildings).

Table 8.17: Extant Planning Application

Reference	PKC Reference	Description	Planning Permission
PA01	19/00410/FLL	Alterations and extension to dwellinghouse to form an additional dwellinghouse (revised design)	Approved
PA02	18/01250/FLL	Formation of an agricultural access track and land engineering (in part retrospect)	Approved
PA03	20/00625/FLL	Erection of a garage	Approved
PA04	20/00687/FLL	Extension to dwellinghouse	Approved
PA05	21/00624/FLL	Siting of container unit for use as hot food takeaway and formation of decking (for temporary period)	Approved
PA06	20/01808/FLL	Change of use and alterations to hotel to form 3 holiday accommodation units, owner's accommodation and a dwellinghouse	Approved
PA07	19/00367/FLL	Erection of a garden building	Approved
PA08	19/00251/FLL	Erection of dwellinghouse	Approved
PA09	18/00309/FLL	Erection of 2no. flats and a dwellinghouse	Approved
PA10	20/00277/FLL	Erection of 4 flats and associated works	Approved
PA11	20/00255/FLL	Erection of a statue	Approved
PA12	19/00263/FLL	Erection of replacement dwellinghouse and garage	Approved
PA13	21/01232/FLL	Erection of 2 flats and associated works	Awaiting Decision
PA14	21/01346/FLL	Formation of a multi use games area, vehicle access, parking area and associated works	Awaiting Decision
PA15	21/00436/FLL	Siting of 14 holiday accommodation units, erection of ancillary building, alterations and extensions to ancillary buildings, formation of landscaping and paths, extension to car parking and associated works.	Awaiting Decision
PA16	21/00121/FLL	Erection of garage/workshop and ancillary accommodation building	Approved
PA17	18/00378/FLL	Installation of a hydro scheme and associated works	Approved

Agricultural Land Holdings

8.3.35 The predominant land use in the study area is forestry, interspersed with a limited number of agricultural fields. The agricultural land supports a limited range of upland (moderate to low production intensity) agricultural systems with livestock production (cattle and sheep), the main farming type. In the case of the forestry land, this is managed for commercial purposes although it also supports other uses, including recreation.

8.3.36 Figure 8.6 shows the distribution of LCA classes in the study area. Whilst much of the area is shown as LCA Class 3.2 (refer to Photograph 8.2), the majority of the land is afforested or urban. Where there are agricultural fields (Newtyle, at the southern end of Birnam, and at Inver Bridge) this is Class 3.1 (land capable of supporting arable agriculture) or 3.2 land (land capable of producing a moderate range of crops). Although the land is capable of growing crops, the fields are predominantly in grass.

Photograph 8.2: LCA Class 3.2 land on Murthly Estate

8.3.37 Within the study area, ten agricultural holdings have been identified. A summary of affected agricultural holdings is provided in Table 8.18, with their location shown on Figure 8.6.

Table 8.18: Agriculture Land Holdings Potentially Affected by the Proposed Route Options

Agricultural Holding Reference	Type of Land Use	Sensitivity
Forestry and Land Scotland	Tay Forest District comprising Craigvinean Forest. Predominantly mature coniferous coupes managed as continuous forest and lying within the River Tay (Dunkeld) National Scenic Area. Forest first established in 1759. The forest supports recreation through forest walks at The Hermitage and in the lower reaches at Ladywell. Open access for horse riding as well as waymarked mountain bike routes and a competition level downhill mountain bike course.	Low
Atholl Estate	Large farming and sporting estate. Land within study area comprises Rotmell Wood and sporting rights on River Tay. Wider estate activities include: Agriculture: cattle, sheep and cropping systems. Forestry: managed for commercial wood production and to support sporting activities, including designated ancient woodland. Environmental Agreements: land subject to environmental management through agricultural, forestry and environmental subsidy schemes. Other: renewables (hydro scheme), equestrianism (trekking and horse trials) and tourism.	Medium
Murthly Estate	Large mixed farming and sporting estate incorporating wider business enterprises. Main business activities include farming, forestry, sporting, property lets, sawmilling and commercial activities in and around Murthly Castle. Estate land supports recreational activities including walks and cycle routes. Agricultural interests within the study area include farmland around Byres of Murthly. Forestry interests consist of Byres Wood, Dalpowie Plantation and Birnam Wood. Sporting interests comprise salmon fishing on the Top Water beat on the River Tay. Land is subject to environmental agreements.	Medium

Agricultural Holding Reference	Type of Land Use	Sensitivity
Invermill Farm	Land used to support equestrian activities. Comprises grazing land, ménage and covered structure.	Medium
Inchmagrannachan Farm	Mixed livestock and arable farm supporting beef and sheep enterprises and arable cropping (mainly cereals). Farm Holiday cottages.	Medium
Land at Ladywell	Grassland and amenity forestry land.	Low
Land at Ladywell Bridge	Scrub-land and amenity woodland.	Low
Ladywell Farm	Grassland farm supporting predominantly cattle enterprise.	Medium
Dalmarnock Fishing Beat and Woodlands Cottage	Salmon fishing lease holder on the River Tay from Dalguise to Rotmell. Self-catering accommodation at Woodlands Cottage including for use as a fishing lodge. Trading as Fish-Tay. Comprises the upper and lower beat with one Fishing Bothy located on the lower beat within the A9 Dualling Programme: Tay Crossing to Ballinluig project (Project 03). Six of the 15 pools are located within the proposed scheme extents.	Very High/High
Dunkeld House Salmon Fishings	Salmon fishing rights holders (owned by Turnhold Estates Limited) on the River Tay from Dunkeld Bridge to Dalguise.	Very High/High

Future Baseline

8.3.38 The PKC LDP2 does not promote large scale residential or commercial developments and future planning applications are expected to be for small-scale infill private property & housing and business developments. No material changes to baseline of community assets or community land are expected. Future baseline of agricultural holdings is expected to be limited to felling and replanting of forestry in accordance with agreed forest plans and for agricultural land in accordance with usual agricultural practices.

8.3.39 The land use baseline for the study area of the proposed route options is unlikely to differ significantly from the existing baseline conditions.

8.4 Potential Impacts and Effects

Introduction

8.4.1 The potential impacts and effects of the proposed route options during construction and operation are reported in this section.

8.4.2 The potential impacts and effects reported are those in the absence of mitigation measures, which would be developed in detail as part of the DMRB Stage 3 design and assessment. However, it should be noted that some aspects that influence land use such as grading out of embankments or alignment to reduce woodland loss have been considered as early 'embedded' mitigation through the DMRB Stage 2 design process and as such are incorporated within each of the proposed route option designs as presented and assessed in this DMRB Stage 2 assessment report.

8.4.3 Land-take (including demolitions) required for both construction and operation of the proposed route options is expected to be the same, and this applies for all proposed route options. Therefore land-take impacts including demolitions are assessed as an operation impact rather than as separate construction and operation impacts. Post construction, it is possible that some of the land acquired for the proposed route options is no longer required for operation of the Preferred Route Option and if this were to be the case, surplus land acquired may be offered back to former owners or their successors in accordance with

the Crichel Down Rules (Scottish Government, 2011). Identification of such land cannot be determined at this stage and so the impacts of the return of any such land cannot be assessed. The location and size of areas required for construction of the proposed route options within the footprint of each of the options is outlined in this section and this includes land required for construction compounds where this has been identified as essential to construct the respective route option. The locations of temporary construction compounds would depend on the appointed Contractor, taking into account environmental constraints. Whilst the appointed Contractor may locate these within the footprint of each of the proposed route options, it is possible that they may be located outwith this area and this would require planning consent for temporary use of land beyond this boundary. This would be subject to separate approvals that would be assessed at the appropriate time.

Construction

8.4.4 The potential impacts and effects during the construction phase result from construction activities as well as the loss of land required to construct and operate the project. Potential impacts include:

- property demolitions;
- disruption and change in accessibility to private property & housing and businesses;
- temporary disruption and changes in accessibility to community assets and land in the settlements of Dunkeld, Birnam and Inver, including Dunkeld & Birnam Station;
- temporary disruption of accessibility to areas of agricultural land holdings including farmland, woodland and private property in close proximity to the construction works and arising from traffic management measures associated with construction related land use and activities;
- reduction in amenity arising from visual impacts associated with construction activities, dust impacts associated with construction activities and movement of plant and machinery, and noise impacts arising from construction impacts and the movement of plant and machinery;
- redirection of watercourses and land drainage systems on agricultural land and woodland causing disruption to the existing land drainage systems. This would require redesign and alternative systems to be developed to avoid increasing flood risk or waterlogging of soils, farmland and woodland;
- disruption and change in accessibility to agricultural land holdings, including key infrastructure;
- disruption to agricultural and forestry boundary features such as fences, hedges and walls requiring the provision of suitable alternative boundary features to secure the boundaries of individual fields and woodland parcels; and
- disruption to public and private utilities (water, gas, electricity and telephone), necessitating localised diversion or provision of alternative supplies.

8.4.5 During construction, there are no potential impacts (excluding loss of land) identified for development land as construction impacts are considered for current land use (private property & housing, businesses and community land).

<u>Impacts and Effects Common to All Route Options</u>

Private Property & Housing and Businesses

8.4.6 During construction, accessibility for vehicles and WCH would be maintained, albeit with expected diversions and potential increases in journey distances and journey time. Private property & housing and business property would also be subject to noise disturbance during construction as reported in Volume 1, Part 3 - Environmental Assessment (Chapter 16: Noise and Vibration).

Community Assets

8.4.7 There are no potential impacts on community assets during construction that are common to all proposed route options. Potential impacts and effects are therefore reported for each proposed route option.

Community Land

8.4.8 The construction of the main alignment and the realigned B867 and Perth Road for all proposed route options is anticipated to result in a temporary change in WCH accessibility and potential reduction in the level use of Torwood Park. The construction of the left-in left-out junction which is proposed for all proposed route options at The Hermitage is also anticipated to result in a temporary change in accessibility for vehicles and WCH, and a potential reduction in the level use of The Hermitage.

Development Land

8.4.9 There are no potential impacts on development land during construction that are common to all proposed route options. Potential impacts and effects are therefore reported for each proposed route option.

Agricultural Land Holdings

8.4.10 There are no potential impacts on agricultural holdings during construction that are common to all proposed route options. Potential impacts and effects are therefore reported for each proposed route option.

8.4.11 All proposed route options would have potential impacts on two sporting interests (categorised as agricultural holdings) during construction: Dalmarnock Fishings and Dunkeld House Salmon Fishings. Fishing would potentially be disrupted but not prevented as a result of the construction of the proposed scheme in the vicinity of Mill Stream and the River Tay Crossing.

8.4.12 The construction works for the proposed scheme would be in the vicinity of five of the fifteen pools on the lower beat of Dalmarnock Fishings. Access to four of the five pools is from the left bank and one pool is accessed from the right bank by combination of vehicle and pedestrian access. WCH access on Path 38 would be maintained during construction, including for anglers, albeit with the potential for a diversion. The potential impact on Dalmarnock Fishings during construction is assessed as being of moderate magnitude and Very Large significance of effect. It is assessed that the potential construction impacts would not compromise viability.

8.4.13 Fishing on Dunkeld House Salmon Fishings is from the left bank, the opposite side to the construction works. WCH access, including for anglers would be unaffected. The potential impact on Dunkeld House Salmon Fishings during construction is assessed as being of minor magnitude and Large significance of effect. It is assessed that the potential construction impacts would not compromise viability.

<u>Impacts and Effects Specific to Option ST2A</u>

Private Property & Housing and Businesses

8.4.14 The construction of Option ST2A is expected to take 4.5 to 5 years with the greatest impacts on private property and businesses being the construction of the Murthly Junction (grade separated), the 1.5km cut and cover tunnel, and the Dunkeld Junction (roundabout). It is expected that construction of the cut and cover tunnel would take 57 months, with the construction of the Murthly, Dunkeld and Dalguise Junctions taking 10, 20 and 27 months respectively. These construction activities are expected to particularly affect houses at Ringwood (construction of Murthly Junction); housing and businesses

properties on Perth Road, Gladstone Terrace, Birnam Terrace, Station Road and Telford Gardens and at Station Cottages and Birnam Glen, south and west of the Highland Main Line railway (construction of cut and cover tunnel); and housing and businesses properties to the south and east of Little Dunkeld (construction of Dunkeld Junction).

8.4.15 Option ST2A would require the acquisition of the Birnam Industrial Estate as a result of the increased carriageway cross-section required for the cut and cover tunnel and to provide a site compound and storage facility for construction.

8.4.16 The presence of the compound in proximity to houses at Station Cottages and on Station Road, Birnam Terrace and Gladstone Terrace may result in impacts on their amenity (potentially visual, dust and noise and vibration impacts). This is considered in more detail in Volume 1, Part 3 - Environmental Assessment (Chapter 13: Visual, Chapter 15: Air Quality and Chapter 16: Noise and Vibration).

8.4.17 Indirect adverse impacts on businesses (refer to paragraph 8.2.35) in Dunkeld, Birnam and Inver are expected during the entire 4.5 to 5 year construction period, potentially affecting change in footfall and visitor numbers and consequently business trade. Some businesses would be particularly affected due to the nature of the business and/or their proximity to the proposed construction works. These potential adverse impacts are particularly likely to affect businesses such as those on Station Road, with accommodation and food providers such as Pinegrove Cottage, Couthie Cottage and the Merryman Hotel particularly susceptible to construction impacts. Conversely, Birnam Village Store may see beneficial impacts due to its proximity to the proposed construction compound on the site of the Birnam Industrial Estate and new construction worker customers.

Community Assets

8.4.18 Construction of a cut and cover tunnel for Option ST2A brings challenges to maintaining access to Dunkeld & Birnam Station during construction. Options to maintain access have been investigated and while they would have engineering and cost implications, they are feasible and would allow the station to remain operational during the construction of a lowered A9 dual carriageway. These options are described in Volume 1, Part 3 - Environmental Assessment (Chapter 7: Overview of Environmental Assessment, paragraphs 7.2.25 to 7.2.36) and would be investigated further should Option ST2A be identified as the Preferred Route Option.

8.4.19 Birnam Arts and Conference Centre would not be directly affected by the proposed works. However, its proximity to the works, specifically the construction of the cut and cover tunnel and the replacement car parking for the Dunkeld & Birnam Station may reduce the footfall using the facility, particularly for passing trade and tourist visitors. However, this may be partially or wholly offset by increased trade from construction workers for services such as food and drink.

Community Land

8.4.20 No construction impacts to community land, other than those reported for all options in paragraph 8.4.8, are anticipated for Option ST2A.

Development Land

8.4.21 Construction impacts on PA05 would be the same as those described for Dunkeld & Birnam Station in paragraph 8.4.18.

Agricultural Land Holdings

8.4.22 A further construction compound is anticipated to be located at Ringwood, in woodland owned by Murthly Estate and would require tree felling works. This would be in addition to loss of woodland arising from the construction of the Murthly Junction on land under the same ownership.

Impacts and Effects Specific to Option ST2B

Private Property & Housing and Businesses

8.4.23 The construction of Option ST2B is expected to take 4 to 4.5 years with the greatest potential impacts on private property & housing and businesses being the construction of the Birnam Junction (grade separated restricted movement), the 150m underpass, and the Dunkeld Junction (roundabout). It is expected that construction of the 150m underpass would take approximately 4 years, with the construction of the Birnam and Dunkeld Junctions taking 8 and 20 months respectively. These construction activities are expected to affect housing and business properties at the south of Birnam (construction of Birnam Junction); housing and business properties on Perth Road, Gladstone Terrace, Birnam Terrace, Station Road and Telford Gardens and at Station Cottages and at Birnam Glen, south and west of the Highland Main Line railway (construction of 150m underpass); and housing and business properties to the south and east of Little Dunkeld (construction of Dunkeld Junction).

8.4.24 Indirect adverse impacts on businesses (as described in paragraph 8.2.35) in Dunkeld, Birnam and Inver are expected during the 4 to 4.5 year construction period, potentially affecting change in footfall and visitor numbers and consequently business trade. Some businesses would be particularly affected due to the nature of the business and/or their proximity to the proposed construction works. These potential adverse impacts are particularly likely to affect businesses such as those on Station Road, with accommodation and food providers such as Pinegrove Cottage, Couthie Cottage and the Merryman Hotel particularly susceptible to construction impacts. Conversely, Birnam Village Store may see beneficial impacts due to its proximity to the proposed construction compound on the site of the Birnam Industrial Estate and new construction worker customers.

Community Assets

8.4.25 Construction of a 150m underpass for Option ST2B brings challenges to maintaining access to Dunkeld & Birnam Station during construction. Options to maintain access have been investigated and while they would have engineering and cost implications, they are feasible and would allow the station to remain operational during the construction of a lowered A9 dual carriageway. These options are described in Volume 1, Part 3 – Environmental Assessment (Chapter 7: Overview of Environmental Assessment, paragraphs 7.2.25 to 7.2.36) and would be investigated further should Option ST2B be identified as the Preferred Route Option.

8.4.26 Potential impacts on Birnam Arts and Conference Centre would likely be similar to those expected for Option ST2A, although for a slightly shorter duration (up to 4.5 years).

Community Land

8.4.27 No construction impacts to community land, other than those reported for all options in paragraph 8.4.8, are anticipated for Option ST2B.

Development Land

8.4.28 Construction impacts on PA05 would be the same as those described for Dunkeld & Birnam Station in paragraph 8.4.25.

Agricultural Land Holdings

8.4.29 The construction of the Birnam Junction would be located in the same location as the anticipated construction compound for Option ST2A at Ringwood, in woodland owned by Murthly Estate and would require tree felling works.

Impacts and Effects Specific to Option ST2C

Private Property & Housing and Businesses

8.4.30 The construction of the Option ST2C is expected to take 2.5 to 3 years with the greatest potential impacts on private property & housing and businesses being the construction of the Birnam Junction (grade separated restricted movement), the replacement car park for Dunkeld & Birnam Station, and the Dunkeld Junction (grade separated all movement). It is expected that construction of the replacement Dunkeld & Birnam Station car park would take 6 months, with the construction of the Birnam and Dunkeld Junctions taking 8 and 20 months respectively. These construction activities are expected to particularly affect housing and business properties at the south of Birnam (construction of Birnam Junction); housing and businesses properties on Perth Road, Gladstone Terrace, Birnam Terrace, Station Road and Telford Gardens and at Station Cottages (construction of Dunkeld & Birnam Station car park); and housing and businesses properties to the south and east of Little Dunkeld (construction of Dunkeld Junction).

8.4.31 Indirect adverse impacts on businesses (as described in paragraph 8.2.35) in Dunkeld, Birnam and Inver are expected during the 2.5 to 3 year construction period, potentially affecting change in footfall and visitor numbers and consequently business trade. Some businesses would be particularly affected due to the nature of the business and/or their proximity to the proposed construction works. These potential adverse impacts are particularly likely to affect businesses such as those on Station Road, with accommodation and food providers such as Pinegrove Cottage, Couthie Cottage and the Merryman Hotel particularly susceptible to construction impacts. Conversely, Birnam Village Store may see beneficial impacts due to its proximity to the proposed replacement station car park on the site of the Birnam Industrial Estate and new construction worker customers.

Community Assets

8.4.32 It is expected that Dunkeld & Birnam Station would be operational at all times during construction of the new car-parking and access arrangements from Station Road. A temporary pedestrian footbridge would be required during construction to maintain access to the station, and this will be investigated further should Option ST2C be identified as the Preferred Route Option.

8.4.33 Potential impacts on Birnam Arts and Conference Centre would likely be similar to those expected for Option ST2A, although for a much shorter duration (up to 3 years).

8.4.34 The construction of the grade separated Dunkeld Junction, including the retaining wall structures, and its proximity to community assets such as Craigvinean Health Centre and Dunkeld and Birnam Recreation Club would also result in impacts such as temporary change in access and potential reduction in use of the recreation club facilities.

Community Land

8.4.35 In addition to the construction impacts on community land reported in paragraph 8.4.8, construction of the grade separated Dunkeld Junction, is anticipated to result in a temporary change in WCH accessibility and a potential reduction in the level of use of the Open Space at Riverside Land.

Development Land

8.4.36 Construction impacts on PA05 would be the same as those described for Dunkeld & Birnam Station in paragraph 8.4.32. In addition, construction impacts on PA14 would be the same as those described for Dunkeld and Birnam Recreation Club in paragraph 8.4.34.

Agricultural Land Holdings

8.4.37 The construction of the Birnam Junction would be located in the same location as the anticipated construction compound for Option ST2A at Ringwood, in woodland owned by Murthly Estate and would require tree felling works.

Impacts and Effects Specific to Option ST2D

Private Property & Housing and Businesses

8.4.38 The construction of Option ST2D is expected to take 2.5 to 3 years with the greatest potential impacts on private property & housing and businesses being the construction of the Birnam Junction (grade separated restricted movement), the Dunkeld & Birnam Station car park, and the Dunkeld Junction (roundabout). It is expected that construction of the replacement Dunkeld & Birnam Station car park would take 6 months, with the construction of the Birnam and Dunkeld Junctions taking 8 and 20 months respectively. These construction activities are expected to particularly affect housing and business properties at the south of Birnam (construction of Birnam Junction); housing and businesses properties on Perth Road, Gladstone Terrace, Birnam Terrace, Station Road and Telford Gardens and at Station Cottages (construction of Dunkeld & Birnam Station car park); and housing and businesses properties to the south and east of Little Dunkeld (construction of Dunkeld Junction).

8.4.39 Indirect adverse impacts on businesses (as described in paragraph 8.2.35) in Dunkeld, Birnam and Inver are expected during the 2.5 to 3 year construction period, potentially affecting change in footfall and visitor numbers and consequently business trade. Some businesses would be particularly affected due to the nature of the business and/or their proximity to the proposed construction works. These potential adverse impacts are particularly likely to affect businesses such as those on Station Road, with accommodation and food providers such as Pinegrove Cottage, Couthie Cottage and the Merryman Hotel particularly susceptible to construction impacts. Conversely, Birnam Village Store may see beneficial impacts due to its proximity to the replacement Dunkeld & Birnam Station car park on the site of the Birnam Industrial Estate and new construction worker customers.

Community Assets

8.4.40 It is expected that Dunkeld & Birnam Station would be operational at all times during construction of the new car-parking and access arrangements from Station Road. A temporary pedestrian footbridge would be required during construction to maintain access to the station and this will be investigated further should Option ST2D be identified as the Preferred Route Option.

8.4.41 Potential impacts on Birnam Arts and Conference Centre would likely be similar to those expected for Option ST2A, although for a much shorter duration (up to 3 years).

Community Land

8.4.42 No construction impacts to community land, other than those reported for all options in paragraph 8.4.8, are anticipated for Option ST2D.

Development Land

8.4.43 Construction impacts on PA05 would be the same as those described for Dunkeld & Birnam Station in paragraph 8.4.40.

Agricultural Land Holdings

8.4.44 The construction of the Birnam Junction would be located in the same location as the construction compound for Option ST2A at Ringwood, in woodland owned by Murthly Estate and would require tree felling works.

Operation

8.4.45 The potential impacts and effects during operation would arise from the permanent land-take required for the long-term operation of this project. The majority of the land-take is expected to be from agricultural land and woodland and this could compromise viability of agricultural holdings if land-take represents a significant proportion of the total land holding. Land required during operation would also include land-take from private property & housing; business properties; community assets; and community land and this direct impact could also affect their amenity and compromise viability.

8.4.46 Changes in traffic patterns could affect local communities including traffic diversions from a business or a change in accessibility to the business. There is the possibility of some loss of trade and, depending on the degree of change and the nature of the business, it may compromise viability. In the case of agricultural holdings, changes in accessibility and traffic flows may require some reorganisation, particularly with regard to the movement of equipment, machinery and vehicles between fields, other land parcels and key infrastructure such as buildings. This combined with the permanent loss of land may compromise viability.

<u>Impacts and Effects Common to All Route Options</u>

Private Property & Housing and Businesses

8.4.47 All proposed route options would result in potential impacts on three houses and two business properties as follows:

- potential demolition of one unoccupied house (Auchlou Cottage);
- potential demolition of two business buildings (Foster Contracting (North) Ltd) and one associated house;
- potential demolition of one business property (currently leased by Aran Bakery);
- potential relocation of an electricity substation;
- partial loss of railway embankments from one land interest (Network Rail Infrastructure Ltd); and
- partial loss of garden and/or woodland from two houses (1 Station Cottages and Rowanlea).

8.4.48 Total predicted land-take from private property & housing and businesses, impacts on viability and indirect impacts on businesses are reported for each proposed route option, and as such impacts and effects are reported for these land interests in each of the route option impact specific sections.

8.4.49 All proposed route options would have potential impacts on access to three telecommunication masts located on land owned by Forestry and Land Scotland. Existing access would be stopped up therefore alternative access to these structures would be considered and developed as part of the DMRB Stage 3 design.

8.4.50 In addition, all proposed route options result in the removal of the A9 Southern Tie-in Interim Roundabout at the northern extents of the proposed scheme (included within Project 03: Tay Crossing to Ballinluig). This would result in the potential for significant effects arising from an increase in journey distance to the north for residents of houses located along the C502 Dunkeld - Rotmell Road including Ledpetty Lodge, Warren Lodge, St Colme's and Rotmell Lodges and for Woodlands as shown in Table 8.19 and on Figure 8.7 .

Table 8.19: Private Property & Housing and Businesses Change in Vehicle Accessibility – to the North and South from the Properties (Common to All Route Options)

Housing/Business Area	Change in Journey Distance (km)		Significance		Figure Ref.
	North	South	North	South	
Properties along B898	+1.0	+<0.1	Slight	Slight	8.7p-q
Woodlands	+3.4	n/a	**Moderate**	n/a	8.7r
Properties along the C502 Dunkeld – Rotmell Road	+3.4	n/a	**Moderate**	n/a	8.7s

8.4.51 Properties along the B898 would experience a change in vehicle accessibility and journey distance when travelling to the area from journeys originating in the north or the south as a result of all proposed route options. Expected change in access route is outlined in Table 8.20 and illustrated on Figure 8.8. This change in vehicle accessibility would not result in the potential for significant effects for journeys from the north or the south.

Table 8.20: Private Property & Housing and Businesses Change in Vehicle Accessibility – from the North and South to the Properties (Common to All Route Options)

Housing/Business Area	Change in Journey Distance (km)		Significance		Figure Ref.
	North	South	North	South	
Properties along B898	+1.1	+0.1	Slight	Slight	8.8p-q

Indirect Impacts on Businesses

8.4.52 All proposed route options would experience increased traffic on the A9 and in Dunkeld and Birnam due to the A9 Dualling Programme as a whole, which encourages trips from other less strategic routes and delivers benefits particularly in terms of connectivity between Inverness and Perth; reducing journey times; improving journey time reliability; and improving road safety.

8.4.53 All proposed route options provide safer access to Dunkeld, Birnam and Inver, encouraging travellers to visit amenities and businesses within the communities, resulting in the potential to increase footfall and visitor numbers during operation. It is noted however, that Option ST2A, Option ST2B and Option ST2D incorporate an at-grade roundabout at Little Dunkeld. This presents a greater risk of an accident occurring at this location when compared to a grade separated junction. Accidents at the proposed roundabout are most likely to be either shunts on the A9 approaches, where an approaching vehicle misjudges traffic conditions and runs into the rear of the vehicle in front, or sideswipe type incidents at the conflict points, as traffic enters the circulatory carriageway. Option ST2C, which incorporates a grade separated junction at Little Dunkeld, reduces the risk of accidents when compared to the at grade roundabout included in the other proposed route options.

8.4.54 It is considered that all proposed route options would fulfil economy related community objectives supporting the promotion of long-term and sustainable economic growth within Dunkeld and Birnam and surrounding communities and thereby supporting the local economy.

Community Assets

8.4.55 Potential impacts and effects on community assets, such as Dunkeld & Birnam Station, are reported for each proposed route option, and as such no impacts are reported as common to all. It should be noted that the potential loss of land from Dunkeld & Birnam Station is reported as under 'Network Rail Infrastructure Ltd' for each proposed route option.

8.4.56 As there are no existing roads used by WCH where the Annual Average Daily Traffic (AADT) flows are in excess of 8,000 vehicles per day (with the exception of the existing A9 and which is not formally crossed by walkers to access community assets), no change to existing severance of community assets is expected to arise from the proposed route options. Therefore, relief from existing severance is not considered further in this assessment. Potential impacts on new severance of community assets are expected and are not common to all proposed route options. Therefore, these potential impacts are reported for each proposed route option.

8.4.57 Note that severance of WCH from private property & housing, businesses and agricultural holdings to rights of way, core paths and local paths is assessed in Volume 1, Part 3 - Environmental Assessment (Chapter 17: Population - Accessibility).

8.4.58 The potential for retaining and replacement of bus stops within the study area would be considered at DMRB Stage 3.

Community Land

8.4.59 Potential land-take impacts on community land such as Little Dunkeld Recreation Park, Riverside Land and The Hermitage, are reported for each proposed route option, and as such no impacts are reported in this section as common to all.

8.4.60 As described in paragraph 8.4.56, there are no existing roads used by WCH where the AADT flows are in excess of 8,000 vehicles per day, and as such, relief from existing severance is not considered further in this assessment. Potential impacts on new severance of community land are expected.

8.4.61 Core Path DUNK/63, as shown on Figure 17.1 as Path 41, provides access to The Hermitage from the east. This core path is expected to be severed by the left in left out junction to access The Hermitage at approximate ch5250 for all proposed route options. There is anticipated to be realignment of the path at this location to maintain WCH access and this would be further developed during the DMRB Stage 3 design process. This change in accessibility is not expected to result in the potential for a significant effect.

Development Land

8.4.62 All proposed route options would result in potential impacts on two sites designated as existing employment land within PKC LDP 2 (Policy 7).

8.4.63 Land allocated under Policy 7 (LA01) is currently used as business premises (Foster Contracting (North) Ltd and Birnam Industrial Estate), and therefore these are assessed as their current use, business property, and the potential impacts and effects are provided in Table 8.21, Table 8.27, Table 8.32 and Table 8.38.

8.4.64 All proposed route options would result in land-take from Foster Contracting (North) Ltd requiring the demolition of two business buildings and associated house within the allocation. This has the potential to affect the development capacity of and accessibility to LA01 (Foster Contracting (North) Ltd) and overall, the significance of effect is assessed as Large.

8.4.65 Potential impacts on development capacity of the development land at Birnam Industrial Estate are not common to all and are therefore reported for each proposed route option.

Agricultural Land Holdings

8.4.66 All proposed route options would potentially impact six agricultural holdings and one sporting land interest as follows:

- Forestry and Land Scotland;
- Atholl Estate;
- Murthly Estate;
- Invermill Farm;
- Inchmagrannachan Farm;
- Ladywell Farm; and
- Dalmarnock Fishings.

8.4.67 Potential impacts on agricultural holdings are reported for each proposed route option, and as such, significance of effects is not reported for these holdings in this section.

8.4.68 In the case of Dalmarnock Fishings, journeys between the upper beat and the lower beat, where the Fishing Bothy is located, are facilitated using the A9 Southern Tie-in Interim Roundabout. This would be removed for all proposed route options with its permanent replacement during operation being the Dalguise Junction. Journey distance during operation of the proposed scheme increases from 9.3km using the A9 Southern Tie-in Interim Roundabout to 12.6km when using the Dalguise Junction, an increase of 3.3km. This change in accessibility is shown on Figure 8.7t. Woodlands Cottage is a property associated with the business (provides accommodation for anglers and other paying guests) and would also experience a change in access. This is reported as a residential/business property in paragraph 8.4.50.

8.4.69 The potential impacts on Dalmarnock Fishings during operation of the proposed scheme and arising from the change in accessibility are assessed as being of moderate magnitude and Large significance of effect. It is assessed that the change in accessibility would not compromise viability and the fishings would continue to be able to operate.

8.4.70 Please refer to Volume 1, Part 3 - Environmental Assessment (Chapter 10: Road Drainage and the Water Environment and Chapter 11: Biodiversity), for potential impacts on water features and fish species respectively.

8.4.71 The approach to reinstating access to individual agricultural holdings is further described in Section 8.5 (Potential Mitigation).

Impacts and Effects Specific to Option ST2A

Private Property & Housing and Businesses

8.4.72 Option ST2A would require land-take from eight houses and six businesses as detailed in Table 8.21. Total land-take from private property & housing and businesses for Option ST2A would be approximately 2.8ha.

8.4.73 The impacts and significance of effects in Table 8.21 are potential only, i.e. in the absence of mitigation. Section 8.5 (Potential Mitigation) of this chapter sets out potential mitigation measures, including design refinement during the DMRB Stage 3 design process.

Table 8.21: Potential Impacts and Effects on Private Property & Housing and Businesses (Option ST2A)

Property Name	Description of Land-take	Loss of land		Sensitivity	Magnitude	Significance
		ha	%			
Private Property & Housing						
1 Station Cottages	Potential partial loss of garden from main alignment.	0.1	37	Very High/High	Moderate	**Very Large**
Auchlou Cottage	Potential demolition of building and potential partial loss of garden from main alignment.	0.1	59	Low	Major	**Moderate**
Rowanlea	Potential partial loss of woodland and garden from main alignment.	<0.1	1	Very High/High	Negligible	Slight
Birnam Bank Cottage	Potential partial loss of garden from access to properties at Birnam Glen.	<0.1	1	Medium	Minor	Slight
Birnam Bank House	Potential partial loss of garden from access to properties at Birnam Glen.	<0.1	4	Medium	Minor	Slight
Glenlea (2 Station Cottages)	Partial loss of woodland from main alignment.	<0.1	<1	Very High/High	Negligible	Slight
The Lodge	Potential partial loss of garden from access to properties at Birnam Glen.	<0.1	1	Medium	Minor	Slight
Tigh-Na-beithe	Potential partial loss of garden from access to properties at Birnam Glen.	<0.1	<1	Medium	Minor	Slight
Businesses						
Foster Contracting (North) Ltd (area also sub-let to Dunkeld Builders)	Potential demolition of two business buildings and one associated house.	0.5	91	Medium	Major	**Large**

Property Name	Description of Land-take	Loss of land		Sensitivity	Magnitude	Significance
		ha	%			
Network Rail Infrastructure Ltd*	Potential partial loss of land (sidings) from main alignment and tie-in at A822 (Old Military Road), B867 and unclassified road to Inver.	0.8	n/a**	Very High/High	Minor	**Large**
Ladywell Landfill	Potential partial loss of woodland from access to properties at Birnam Glen.	0.8	19	Very High/High	Moderate	**Very Large**
Aran Bakery	Potential demolition of business property from access to station car park.	0.1	100	Very High/High	Major	**Very Large**
Birnam Industrial Estate (including Lonely Mountain Skis, Merriman Joinery, Dunkeld Plumbers and T&M Developments)	Potential loss of industrial estate including demolition of two business units for construction of cut and cover tunnel.	0.4	100	Very High/High	Major	**Very Large**
Substation site by Birnam Industrial Estate	Relocation of electrical substation required.	<0.1	100	Very High/High	Major	**Very Large**

*potential impact on Dunkeld & Birnam Station is assessed under 'Community Assets'
**% area of loss has not been calculated due to the overall extent of the land interests land holdings.

8.4.74 The potential for significant effects has been identified for two houses and six businesses (one of which also includes one associated house) as a result of Option ST2A.

8.4.75 Foster Contracting (North) Ltd (also including Dunkeld Builders) and businesses located on Birnam Industrial Estate (including Lonely Mountain Skis, Merriman Joinery, Dunkeld Plumbers and T&M Developments) would no longer be able to operate at these locations due to land-take and the demolition of two business buildings and two business units resulting from Option ST2A. The potential for an effect of Very Large significance is assessed for Birnam Industrial Estate (including Lonely Mountain Skis, Merriman Joinery, Dunkeld Plumbers and T&M Developments) and an effect of Large significance is assessed for Foster Contracting (North) Ltd (also including Dunkeld Builders), and viability of these businesses is expected to be compromised due to the requirement for their relocation.

8.4.76 Aran Bakery has a café located within Dunkeld and rents a commercial building at Birnam Industrial Estate for food production and preparation. Option ST2A would result in the loss of this building and the business would require relocation of part of its activities to another commercial premises. The potential for an effect of Very Large significance is assessed and viability is expected to be compromised due to the change in land use and requirement for the business' relocation.

8.4.77 Ladywell Landfill would be affected by permanent land-take (0.8ha of woodland). However, this is not expected to directly affect the landfill cell. The potential for an effect of Very Large significance is assessed. However, this would not be expected to compromise viability as there would likely be no overall change in land use.

8.4.78 In addition to the areas in Table 8.19, six housing/business areas would experience a change in vehicle accessibility and journey distance when travelling to the A9 as a result of Option ST2A. Expected change in vehicle accessibility for each housing/business area is outlined in Table 8.22 and illustrated on Figure 8.7. One of the journeys would have the potential to experience significant effects on accessibility (Moderate (beneficial)).

Table 8.22: Private Property & Housing and Businesses Change in Vehicle Accessibility – to the North and South from the Properties (Option ST2A)

Housing/Business Area	Change in Journey Distance (km)		Significance		Figure Ref.
	North	South	North	South	
Byres of Murthly	-0.1	-2.6	Slight (Beneficial)	**Moderate (Beneficial)**	8.7a-b
Murthly Estate	+0.1	-<0.1	Slight	Slight (Beneficial)	8.7c-d
Properties at Ringwood	+1.2	-1.4	Slight	Slight (Beneficial)	8.7e-f
Little Dunkeld and Birnam	+0.1	+0.2	Slight	Slight	8.7g-h
Properties at Birnam Glen	-0.3	+1.1	Slight (Beneficial)	Slight	8.7i-j
Inver	+0.1	+<0.01	Slight	Slight	8.7m-n

8.4.79 In addition to the areas in Table 8.20, six housing/business area would experience a change in accessibility when travelling to the housing/business area from journeys originating in the north or the south as a result of Option ST2A. Expected change in access route for each housing/business area is outlined in Table 8.23 and illustrated on Figure 8.8. One of the journeys would have the potential to experience significant (Moderate (beneficial)) effects on accessibility.

Table 8.23: Private Property & Housing and Businesses Change in Vehicle Accessibility – from the North and South to the Properties (Option ST2A)

Housing/Business Area	Change in Journey Distance (km)		Significance		Figure Ref.
	North	South	North	South	
Byres of Murthly	+0.1	-2.7	Slight	**Moderate (Beneficial)**	8.8a-b
Murthly Estate	+<0.1	+0.1	Slight	Slight	8.8c-d
Properties at Ringwood	+1.3	-1.5	Slight	Slight (Beneficial)	8.8e-f
Little Dunkeld and Birnam	-<0.1	+0.1	Slight (Beneficial)	Slight	8.8g-h
Properties at Birnam Glen	-0.2	+0.8	Slight (Beneficial)	Slight	8.8i-j
Inver	+0.3	-<0.1	Slight	Slight (beneficial)	8.8m-n

8.4.80 The Dunkeld Junction would provide connections to the A9 (north and south), A923, A822 (Old Military Road) and the unclassified road to Inver. Traffic modelling for the project shows traffic growth within Little Dunkeld, Dunkeld and Birnam and, in combination with appropriate tourist signage for local amenities, it is anticipated that visitor numbers to local amenities and some commercial properties (such as accommodation providers and retailers) would increase due to greater passing trade. The connection of Dunkeld & Birnam Station to Station Road within Birnam and then indirectly to Little Dunkeld and Dunkeld may also result in greater passing trade for businesses, particularly those in its vicinity.

Consequently, some businesses in this location may see an indirect beneficial impact from Option ST2A, supporting the continued viability of business as a land use.

Community Assets

8.4.81 Option ST2A necessitates land-take from the existing Dunkeld & Birnam Station, with partial loss of the existing parking area. New vehicular access to the station and replacement parking would be provided as part of the design, from an extension to Station Road and a structure over the tunnelled section of the proposed A9.

8.4.82 Users of Dunkeld & Birnam Station would experience a change in access when travelling to the station from journeys originating in the north or the south with Option ST2A. Changes in accessibility would also be anticipated when travelling from the station to the A9. The expected change in accessibility for users of Dunkeld & Birnam Station is outlined in Table 8.24 and illustrated on Figure 8.7 and Figure 8.8.

Table 8.24: Dunkeld & Birnam Station Change in Vehicle Accessibility – to/from the North and South (Option ST2A)

Direction of travel	Change in Journey Distance (km)	Significance	Figure Ref.
To the north from the station	+0.2	Slight	8.7k
To the south from the station	+0.4	Slight	8.7l
From the north to the station	+0.1	Slight	8.8k
From the south to the station	+0.4	Slight	8.8l

8.4.83 Birnam Arts and Conference Centre would potentially see an increase in footfall and visitor numbers due to the connectivity of Dunkeld & Birnam Station with Station Road. This, combined with its improved connection to public transport links may result in an indirect beneficial impact from Option ST2A, supporting the continued land use and viability of the community asset as an events and conference centre.

8.4.84 Core Path DUNK/11, as shown on Figure 17.1 as Path 28, provides access for residents at Birnam Glen to community assets located in Little Dunkeld. This core path is expected to be diverted with a change in journey length as a result of the lowering of Option ST2A in this location. This diversion would be developed further during the DMRB Stage 3 design process. Please refer to Volume 1, Part 3 - Environmental Assessment (Chapter 17: Population - Accessibility) for more details. This change in accessibility is not expected to result in the potential for a significant effect.

Community Land

8.4.85 Option ST2A would result in potential land-take of approximately 0.2ha from community land at Little Dunkeld Recreation Park, The Hermitage and Riverside Land. This land-take equates to 3%, 1% and 2% respectively of the total land plot area. Land-take from Little Dunkeld Recreation Park and Riverside Land would be required for the Dunkeld Junction and the main alignment near the crossing of the River Braan. Land-take from The Hermitage would be required for the left-in left-out junction provided at ch5250. Of this, 0.1ha is designated as Open Space (Little Dunkeld Recreation Park and Riverside Land) as identified in the PKC LDP 2.

8.4.86 Land-take and loss of amenity from Little Dunkeld Recreation Park, The Hermitage and Riverside Land is not expected to affect the use of these sites as community land and as a result, the potential for significant effects are assessed as being not significant for Option ST2A.

8.4.87 Option ST2A provides the opportunity to create a new community land of approximately 4.6ha that could be used by the local community. For the purposes of this assessment, it is assumed to be undesignated Open Space and supports compliance with Policy 14 (Open Space Retention and Provision) (refer to Table 8.15) and offsets for loss of community land and Open Space. The net gain in community land would be approximately 3.8ha. The design use and designation of this area would be considered further during the DMRB Stage 3 design process.

8.4.88 Users of The Hermitage would experience a change in accessibility and journey distance for vehicle journeys originating in the north as a result of Option ST2A. Changes in vehicle access would also arise when travelling from The Hermitage to the A9. These changes are assessed as having the potential for effects of Very Large significance. Expected change in access for The Hermitage is outlined in Table 8.25 and illustrated on Figure 8.7 and Figure 8.8.

Table 8.25: The Hermitage Change in Vehicle Accessibility – to/from the North and South (Option ST2A)

Direction of travel	Change in Journey Distance (km)	Significance	Figure Ref.
To the north from The Hermitage	No change	-	-
To the south from The Hermitage	+3.7	**Very Large**	8.7o
From the north to The Hermitage	+2.5	**Very Large**	8.8o
From the south to The Hermitage	No change	-	-

Development Land

8.4.89 Option ST2A would result in land-take from Birnam Industrial Estate (Land allocation LA01) and land-take from the affected businesses is reported in Table 8.21. This has the potential to affect the development capacity of, and accessibility to, LA01 and overall, the potential for effects of Large significance is assessed.

8.4.90 Option ST2A is expected to result in land-take from PA03 which is reported in Table 8.21 under the Lodge property. The planning application proposes the 'Erection of a garage' which would not be affected by Option ST2A and overall, the potential for effects of Slight significance is assessed.

8.4.91 Option ST2A is expected to result in land-take from only the boundary of PA04, proposing the 'Extension to dwellinghouse'. Due to the Medium sensitivity of the planning application and Negligible impact magnitude, the potential for effects of Slight significance is assessed.

8.4.92 In addition, Option ST2A is expected to result in changes in access to PA05. The change in access to PA05 would be the same as those described for Dunkeld & Birnam Station in paragraph 8.4.82 and Table 8.24.

Agricultural Land Holdings

8.4.93 Option ST2A would potentially have direct land-take impacts on seven agricultural holdings with total land-take of approximately 28.3ha, as shown in Table 8.26.

Table 8.26: Potential Impacts and Effects on Agricultural Land Holdings (Option ST2A)

Agricultural Holding Reference	Approximate Land-take (ha)				No. Fields	Magnitude	Significance
	Prime land	Non-prime land	Woodland	Total			
Forestry and Land Scotland	<0.1	0.4	9.0	9.4	17	Moderate	Slight
Atholl Estate	<0.1	0.3	0.3	0.7	13	Minor	Slight
Murthly Estate	0.4	3.0	10.6	13.9	16	Moderate	**Moderate**
Invermill Farm	0.0	0.6	0.1	0.7	4	Minor	Slight
Inchmagrannachan Farm	0.4	2.6	<0.1	3.0	2	Minor	Slight
Land at Ladywell	0.0	0.0	0.4	0.4	1	Minor	Slight
Ladywell Farm	0.0	0.1	<0.1	0.2	3	Minor	Slight
Total:	**0.9**	**7.0**	**20.4**	**28.3**	**56**		

8.4.94 The agricultural holdings listed in Table 8.26 would be affected by land-take, and disruption to field boundary features, field access points and land drainage systems. In the case of Forestry and Land Scotland, Invermill Farm (land on the north side of the A9), and Inchmagrannachan farmland south of the River Tay Crossing, direct accesses from the A9 would be stopped up. Alternative access is assumed to be provided and this would be developed at DMRB Stage 3 and as such this impact assessment assumes alternative access would be provided.

8.4.95 The potential for effects of Moderate significance has been assessed for Murthly Estate. It is considered that the combination of land-take and change in accessibility would not compromise the viability of this agricultural holding and there would be no overall change in land use. The potential for effects of Slight significance have been assessed for the remaining agricultural holdings.

Impacts and Effects Specific to Option ST2B

Private Property & Housing and Businesses

8.4.96 Option ST2B would require land-take from seven houses and five businesses as detailed in Table 8.27. Total land-take from private property & housing and businesses for Option ST2B would be approximately 2.3ha.

8.4.97 The impacts and effects in Table 8.27 are potential only, i.e. in the absence of mitigation. Section 8.5 (Potential Mitigation) of this chapter sets out potential mitigation measures, including refinement of the DMRB Stage 3 design.

Table 8.27: Potential Impacts and Effects on Private Property & Housing and Businesses (Option ST2B)

Property Name	Description of Land-take	Loss of land		Sensitivity	Magnitude	Significance
		ha	%			
Private Property & Housing						
1 Station Cottages	Potential partial loss of garden from main alignment and works to Station Road.	<0.1	21	Very High/High	Moderate	**Very Large**
Auchlou Cottage	Potential demolition of building and potential partial loss of garden from main alignment.	0.1	59	Low	Major	**Moderate**
Rowanlea	Potential partial loss of woodland and garden from main alignment.	<0.1	7	Very High/High	Minor	**Large**
Birnam Bank Cottage	Potential partial loss of garden from access to properties at Birnam Glen.	<0.1	1	Medium	Minor	Slight
Birnam Bank House	Potential partial loss of garden from access to properties at Birnam Glen.	<0.1	4	Medium	Minor	Slight
The Lodge	Potential partial loss of garden from access to properties at Birnam Glen.	<0.1	1	Medium	Minor	Slight
Tigh-Na-beithe	Potential partial loss of garden from access to properties at Birnam Glen.	<0.1	<1	Medium	Minor	Slight
Businesses						
Foster Contracting (North) Ltd (area also sub-let to Dunkeld Builders)	Potential demolition of two business buildings and one associated house.	0.5	91	Medium	Major	**Large**
Network Rail Infrastructure Ltd*	Potential partial loss of land (sidings) from main alignment and tie-in at A822 (Old Military Road), B867 and unclassified road to Inver.	0.8	n/a**	Very High/High	Minor	**Large**
Ladywell Landfill	Potential partial loss of woodland from access to properties at Birnam Glen.	0.8	19	Very High/High	Moderate	**Very Large**
Aran Bakery	Potential demolition of business property from access to station car park.	<0.1	18	Very High/High	Moderate	**Very Large**
Birnam Industrial Estate	Potential partial loss of industrial estate access (no demolitions) for construction of tie-in from Station Road	<0.1	2	Very High/High	Negligible	Slight

Property Name	Description of Land-take	Loss of land		Sensitivity	Magnitude	Significance
		ha	%			
Substation site by Birnam Industrial Estate	Relocation of electrical substation required.	<0.1	100	Very High/High	Major	**Very Large**

*potential impact on Dunkeld & Birnam Station is assessed under 'Community Assets'
**% area of loss has not been calculated due to the overall extent of the land interests land holdings.

8.4.98 The potential for significant effects has been identified for three houses and five businesses (one of which also includes one associated house) as a result of Option ST2B.

8.4.99 Potential impacts on viability would be similar to Option ST2A as previously detailed in paragraphs 8.4.75 to 8.4.77, with the exception that there would be reduced land-take from Birnam Industrial Estate and no demolitions and so businesses within the Birnam Industrial Estate (including Lonely Mountain Skis, Merriman Joinery, Dunkeld Plumbers and T&M Developments) would remain viable.

8.4.100 In addition to the areas identified in Table 8.19, six housing/business areas would experience a change in vehicle access and journey distance when travelling to the A9 as a result of the Option ST2B. Expected change in vehicle access route for each housing/business area is outlined in Table 8.28 and illustrated on Figure 8.7. One of the journeys would have the potential to experience significant effects on accessibility of Moderate significance.

Table 8.28: Private Property & Housing and Businesses Change in Vehicle Accessibility – to the North and South from the Properties (Option ST2B)

Housing/Business Area	Change in Journey Distance (km)		Significance		Figure Ref.
	North	South	North	South	
Byres of Murthly	+0.1	+0.3	Slight	Slight	8.7a-b
Murthly Estate	+0.3	+3.1	Slight	**Moderate**	8.7c-d
Properties at Ringwood	+0.1	+0.3	Slight	Slight	8.7e-f
Little Dunkeld and Birnam	+0.1	-<0.1	Slight	Slight (Beneficial)	8.7g-h
Properties at Birnam Glen	-0.3	+1.1	Slight (Beneficial)	Slight	8.7i-j
Inver	+0.1	+<0.1	Slight	Slight	8.7m-n

8.4.101 In addition to the areas identified in Table 8.20, six housing/business areas would experience a change in accessibility when travelling to the housing/business areas from journeys originating in the north or the south as a result of Option ST2B. Expected change in access route and change in journey distance for each housing/business area is outlined in Table 8.29 and illustrated on Figure 8.8. One of the journeys from the housing/business areas would result in significant (Moderate) effects on accessibility.

Table 8.29: Private Property & Housing and Businesses Change in Vehicle Accessibility – from the North and South to the Properties (Option ST2B)

Housing/Business Area	Change in Journey Distance (km)		Significance		Figure Ref.
	North	South	North	South	
Byres of Murthly	+0.1	-0.3	Slight	Slight (Beneficial)	8.8a-b
Murthly Estate	+0.3	+2.5	Slight	**Moderate**	8.8c-d
Properties at Ringwood	+0.1	-0.3	Slight	Slight (Beneficial)	8.8e-f
Little Dunkeld and Birnam	-<0.1	+0.1	Slight (Beneficial)	Slight	8.8g-h
Properties at Birnam Glen	-0.2	+0.8	Slight (Beneficial)	Slight	8.8i-j
Inver	+0.3	-<0.1	Slight	Slight (beneficial)	8.8m-n

8.4.102 Similar to Option ST2A, there is the potential for indirect beneficial impacts arising from Option ST2B associated with junction improvements to Birnam, Little Dunkeld and Dunkeld supporting the continued viability of business as a land use in these settlements.

Community Assets

8.4.103 Option ST2B necessitates land-take from the existing Dunkeld & Birnam Station with partial loss of the existing parking area. New vehicular access to the station and replacement parking would be provided, within the proposed route option, from an extension to Station Road and an underpass structure over the proposed A9.

8.4.104 Users of Dunkeld & Birnam Station would experience a change in accessibility when travelling to the station from the north or the south with Option ST2B. Changes in accessibility would also be anticipated when travelling from the station to the A9. The expected change in access for users of Dunkeld & Birnam Station is outlined in Table 8.30 and illustrated on Figure 8.7 and Figure 8.8.

Table 8.30: Dunkeld & Birnam Station Change in Vehicle Accessibility – to/from the North and South (Option ST2B)

Direction of travel	Change in Journey Distance (km)	Significance	Figure Ref.
To the north from the station	+0.2	Slight	8.7k
To the south from the station	+0.2	Slight	8.7l
From the north to the station	+0.1	Slight	8.8k
From the south to the station	+0.4	Slight	8.8l

8.4.105 Birnam Arts and Conference Centre would potentially see an increase in footfall and visitor numbers due to the connectivity of Dunkeld & Birnam Station with Station Road. This, combined with its improved connection to public transport links may result in an indirect beneficial impact from Option ST2B, supporting the continued land use and viability of the community asset as an events and conference centre.

8.4.106 Potential impacts and effects on accessibility of community assets are expected to be the same as Option ST2A (refer to paragraph 8.4.81 to 8.4.84).

Community Land

8.4.107 Potential impacts and effects on existing community land are expected to be the same as Option ST2A (refer to paragraphs 8.4.84 to 8.4.88) with the exception that Option ST2B would not facilitate the creation of new recreation space.

Development Land

8.4.108 Option ST2B would result in land-take from the Birnam Industrial Estate (Land allocation LA01). However, Option ST2B would not result in land-take from businesses located within the Land allocation and as such is not anticipated to affect the development capacity of, as well as accessibility to, land allocation LA01 at Birnam Industrial Estate. Overall, the potential for effects of Slight significance is assessed.

8.4.109 Option ST2B is expected to result in land-take from PA03 which is reported in Table 8.27 under the Lodge property. The planning application proposes the 'Erection of a garage' which would not be affected by Option ST2B and overall, the potential for effects of Slight significance is assessed.

8.4.110 In addition, Option ST2D is expected to result in changes in access to PA05. Changes in access to PA05 would be the same as described for Dunkeld & Birnam Station in paragraph 8.4.104 and Table 8.30.

Agricultural Land Holdings

8.4.111 Option ST2B would potentially impact on seven agricultural holdings resulting in total land-take of approximately 24.4ha, as shown in Table 8.31.

Table 8.31: Potential Impacts and Effects on Agricultural Land Holdings (Option ST2B)

Agricultural Holding Reference	Approximate Land-take (ha)				No. Fields	Magnitude	Significance
	Prime land	Non-prime land	Woodland	Total			
Forestry and Land Scotland	<0.1	0.4	9.0	9.4	17	Moderate	Slight
Atholl Estate	<0.1	0.3	0.3	0.6	8	Minor	Slight
Murthly Estate	0.5	2.0	7.6	10.1	16	Moderate	**Moderate**
Invermill Farm	0.0	0.6	0.1	0.7	4	Minor	Slight
Inchmagrannachan Farm	0.4	2.6	<0.1	3.0	2	Minor	Slight
Land at Ladywell	0.0	0.0	0.4	0.4	1	Minor	Slight
Ladywell Farm	0.0	0.1	0.1	0.2	3	Minor	Slight
Total:	**0.9**	**6.0**	**17.5**	**24.4**	**51**		

8.4.112 The agricultural holdings listed in Table 8.31 would be affected by land-take and disruption to field boundary features, field access points and land drainage systems. In the case of Forestry and Land Scotland, Invermill Farm (land on the north side of the A9), and Inchmagrannachan farmland south of the River Tay Crossing, direct accesses from the A9 would be stopped up. This impact assessment has assumed that alternative access would be provided, and this would be developed at DMRB Stage 3.

8.4.113 The potential for effects of Moderate significance has been assessed for Murthly Estate. It is assessed that the combination of land-take and change in accessibility would not compromise viability of this

agricultural holding and there would be no overall change in land use. The potential for effects of Slight significance have been assessed for the remaining agricultural holdings.

Impacts and Effects Specific to Option ST2C

Private Property & Housing and Businesses

8.4.114 Option ST2C would require land-take from four houses and five businesses as detailed in Table 8.32. Total land-take from private property & housing and businesses for Option ST2C would be approximately 2.6ha.

8.4.115 The impacts and effects in Table 8.32 are potential only, i.e. in the absence of mitigation. Section 8.5 (Potential Mitigation) of this chapter sets out potential mitigation measures, including refinement of the DMRB Stage 3 design.

Table 8.32: Potential Impacts and Effects on Private Property & Housing and Businesses (Option ST2C)

Property Name	Description of Land-take	Loss of land		Sensitivity	Magnitude	Significance
		ha	%			
Private Property & Housing						
1 Station Cottages	Potential partial loss of garden from main alignment.	0.1	38	Very High/High	Moderate	**Very Large**
Auchlou Cottage	Demolition of building and potential partial loss of garden from main alignment.	0.1	61	Low	Major	**Moderate**
Rowanlea	Potential partial loss of woodland and garden from main alignment.	<0.1	10	Very High/High	Minor	**Large**
Glenlea (2 Station Cottages)	Partial loss of woodland from main alignment.	<0.1	2	Very High/High	Negligible	Slight
Businesses						
Foster Contracting (North) Ltd (area also sub-let by Dunkeld Builders)	Potential demolition of two industrial buildings and one associated residential property.	0.5	100	Medium	Major	**Large**
Network Rail Infrastructure Ltd*	Potential partial loss of land (sidings) from main alignment and tie-in at A822 (Old Military Road), B867 and unclassified road to Inver.	1.5	n/a**	Very High/High	Minor	**Large**
Substation site by Birnam Industrial Estate	Relocation of electrical substation required.	<0.1	100	Very High/High	Major	**Very Large**
Aran Bakery	Potential demolition of commercial property from access to station car park.	0.1	100	Very High/High	Major	**Very Large**

Property Name	Description of Land-take	Loss of land		Sensitivity	Magnitude	Significance
		ha	%			
Birnam Industrial Estate (including Lonely Mountain Skis, Merriman Joinery, Dunkeld Plumbers and T&M Developments)	Potential loss of industrial estate including demolition of two industrial units for replacement station car park.	0.4	84	Very High/High	Major	**Very Large**

*potential impact on Dunkeld & Birnam Station is assessed under 'Community Assets'
**% area of loss has not been calculated due to the overall extent of the land interests land holdings.

8.4.116 The potential for significant effects has been identified for three houses and five businesses (one of which also includes one associated house) as a result of Option ST2C.

8.4.117 Potential impacts on viability are expected to be the similar to Option ST2A, with the exception that Ladywell Landfill would not be affected.

8.4.118 Whilst Option ST2C would not provide the same direct vehicular connection to Dunkeld & Birnam Station as Option ST2A and Option ST2B, there would be direct access from the station to Station Road, Birnam, Little Dunkeld and Dunkeld. This would be expected to have similar indirect beneficial impacts to Options ST2A and ST2B on the viability of business as a land use in these settlements.

8.4.119 In addition to the areas identified in Table 8.19, six housing/business areas would experience a change in vehicle accessibility when travelling to the A9 as a result of the Option ST2C. Expected change in vehicle access route for each housing/business area is outlined in Table 8.33 and illustrated on Figure 8.7. One journey from one housing/business area would have the potential to experience significant (Moderate) effects on accessibility.

Table 8.33: Private Property & Housing and Businesses Change in Vehicle Access – to the North and South from the Properties (Option ST2C)

Housing/Business Area	Change in Journey Distance (km)		Significance		Figure Ref.
	North	South	North	South	
Byres of Murthly	+0.1	+0.3	Slight	Slight	8.7a-b
Murthly Estate	+0.3	+3.1	Slight	**Moderate**	8.7c-d
Properties at Ringwood	+0.1	+0.3	Slight	Slight	8.7e-f
Little Dunkeld and Birnam	+0.1	-<0.1	Slight	Slight (Beneficial)	8.7g-h
Properties at Birnam Glen	+0.1	-<0.1	Slight	Slight (Beneficial)	8.7i-j
Inver	+0.1	No change	Slight	Neutral	8.7m-n

8.4.120 In addition to the areas identified in Table 8.20, six housing/business areas would experience a change in access when travelling to the housing/business areas from journeys originating in the north or the south as a result of Option ST2C. Expected change in access route for each housing/business area is outlined in Table 8.34 and illustrated on Figure 8.8. One journey would have the potential to experience significant (Moderate) effects on accessibility.

Table 8.34: Private Property & Housing and Businesses Change in Vehicle Access – from the North and South to the Properties (Option ST2C)

Housing/Business Area	Change in Journey Distance (km)		Significance		Figure Ref.
	North	South	North	South	
Byres of Murthly	+0.1	-0.3	Slight	Slight (Beneficial)	8.8a-b
Murthly Estate	+0.3	+2.5	Slight	**Moderate**	8.8c-d
Properties at Ringwood	+0.1	-0.3	Slight	Slight (Beneficial)	8.8e-f
Little Dunkeld and Birnam	-<0.1	+0.1	Slight (Beneficial)	Slight	8.8g-h
Properties at Birnam Glen	+<0.1	+0.1	Slight	Slight	8.8i-j
Inver	+0.4	-0.1	Slight	Slight (Beneficial)	8.8m-n

Community Assets

8.4.121 Option ST2C would potentially impact on the existing Dunkeld & Birnam Station through partial loss of the existing parking area. Replacement car parking would be provided as part of the proposed route option, from Station Road utilising the land currently occupied by the Birnam Industrial Estate. Pedestrian access to the station is proposed from this location via a pedestrian underpass and incorporating a lift allowing Equality Act 2010 compliant access to Platform 1 of Dunkeld & Birnam Station.

8.4.122 Users of Dunkeld & Birnam Station would experience a change in accessibility when travelling to the station from journeys originating in the north or the south as a result of Option ST2C. Changes in accessibility would also be anticipated when travelling from the station to the A9. Expected change in accessibility for Dunkeld & Birnam Station is outlined in Table 8.35 and illustrated on Figure 8.7 and Figure 8.8.

Table 8.35: Dunkeld & Birnam Station Change in Vehicle Accessibility – to/from the North and South (Option ST2C)

Direction of travel	Change in Journey Distance (km)	Significance	Figure Ref.
To the north from the station	+0.2	Slight	8.7k
To the south from the station	+0.2	Slight	8.7l
From the north to the station	+0.1	Slight	8.8k
From the south to the station	+0.3	Slight	8.8l

8.4.123 Birnam Arts and Conference Centre would potentially see an increase in footfall and visitor numbers due to the connectivity of Dunkeld & Birnam Station with Station Road. This, combined with its improved connection to public transport links may result in an indirect beneficial impact from Option ST2C, supporting the continued land use and viability of the community asset as an events and conference centre.

Community Land

8.4.124 Option ST2C would result in potential total land-take of approximately 0.7ha from community land which includes open amenity ground at Inchewan Burn, Little Dunkeld Recreation Park, The Hermitage and Riverside land. This land-take equates to 75%, 9%, 1% and 6% respectively, of the total land plot areas. Land-take from open amenity ground at Inchewan Burn is from a SuDS pond at ch3500. Land-take from Riverside Land and Little Dunkeld Recreation Park is from the main alignment. Land-take from The Hermitage is expected to be from the left-in left-out junction provided at ch5250. Of this, 0.3ha is designated as Open Space (Little Dunkeld Recreation Park and Riverside Land) as identified in the PKC LDP 2.

8.4.125 Land-take and loss of amenity from Little Dunkeld Recreation Park, The Hermitage and Riverside Land is not expected to affect the use of these sites as community land and as a result the potential for significant effects are not anticipated.

8.4.126 Land-take from open amenity ground at Inchewan Burn would be lost due to the creation of a SuDS basin and the extent of the land-take is assessed as having the potential to be a significant effect.

8.4.127 Users of The Hermitage would experience a change in accessibility for journeys originating in the north. Changes in accessibility would also be anticipated when travelling from The Hermitage to the A9. Expected change in accessibility for The Hermitage is outlined in Table 8.36 and illustrated on Figure 8.7 and Figure 8.8.

Table 8.36: The Hermitage Change in Vehicle Access – to/from the North and South (Option ST2C)

Direction of travel	Change in Journey Distance (km)	Significance	Figure Ref.
To the north from The Hermitage	No change	-	-
To the south from The Hermitage	+3.7	**Very Large**	8.7o
From the north to The Hermitage	+2.6	**Very Large**	8.8o
From the south to The Hermitage	No change	-	-

Development Land

8.4.128 Option ST2C would result in land-take from development land at Birnam Industrial Estate (Land allocation LA01) which is reported in Table 8.32. This has the potential to affect the development capacity of and accessibility to LA01 and overall, the potential for effects of Large significance is assessed.

8.4.129 Option ST2C is expected to result in land-take from PA07 which is reported in Table 8.32 under the Glenlea Residential property. The planning application proposes the 'erection of a garden building' which would not be directly affected by Option ST2C and overall, the potential for significant effects is assessed as Slight.

8.4.130 Option ST2C is expected to result in land-take of less than 0.1ha from PA14. The planning application is awaiting decision and proposes the 'formation of multi-use games area, vehicular access, parking area and associated works'. Option ST2C intersects with PA14 within land currently owned by the Scottish Ministers. As the planning application is awaiting decision, and the land-take would be from land outwith the control of the applicant, the potential for significant effects is assessed as Slight.

8.4.131 In addition, Option ST2C is anticipated to result in changes in access to PA05. The change is access to PA05 would be the same as those described in paragraph 8.4.121 to 8.4.122 and Table 8.35.

Agricultural Land Holdings

8.4.132 Option ST2C would potentially affect seven agricultural holdings resulting in total land-take from agricultural holdings of approximately 25.6ha, as shown in Table 8.37.

Table 8.37: Potential Impacts and Effects on Agricultural Land Holdings (Option ST2C)

Agricultural Holding Reference	Approximate Land-take (ha)				No. Fields	Magnitude	Significance
	Prime land	Non-prime land	Woodland	Total			
Forestry and Land Scotland	<0.1	0.4	10.7	11.2	15	Moderate	Slight
Atholl Estate	<0.1	0.3	0.3	0.7	13	Minor	Slight
Murthly Estate	0.5	1.9	7.6	10.0	16	Moderate	**Moderate**
Invermill Farm	0.0	0.6	0.1	0.7	4	Minor	Slight
Inchmagrannachan Farm	0.4	2.6	<0.1	3.0	2	Minor	Slight
Land at Ladywell	0.0	<0.1	0.0	<0.1	1	Minor	Slight
Ladywell Farm	0.0	<0.1	0.0	<0.1	0	Minor	Slight
Total:	**0.9**	**5.9**	**18.7**	**25.6**	**51**		

8.4.133 The agricultural holdings listed in Table 8.37 would be affected by land-take and disruption to field boundary features, field access points and land drainage systems. In the case of Forestry and Land Scotland, Invermill Farm (land on the north side of the A9), and Inchmagrannachan farmland south of the River Tay Crossing, direct accesses from the A9 would be stopped up. This impact assessment has assumed that alternative access would be provided, and this would be developed at DMRB Stage 3.

8.4.134 The potential for effects of Moderate significance has been assessed for Murthly Estate. It is assessed that the combination of land-take and change in accessibility would not compromise viability for this agricultural holding and there would be no overall change in land use. The potential for effects of Slight significance has been assessed for the remaining agricultural holdings.

Impacts and Effects Specific to Option ST2D

Private Property & Housing and Businesses

8.4.135 Option ST2D would require land-take from four houses and five businesses as detailed in Table 8.38. Total land-take from private property & housing and businesses for Option ST2D would be approximately 2.3ha.

8.4.136 The impacts and effects in Table 8.38 are potential only, i.e. in the absence of mitigation. Section 8.5 (Potential Mitigation) of this chapter sets out potential mitigation measures, including refinement of the DMRB Stage 3 design.

Table 8.38: Potential Impacts and Effects on Private Property & Housing and Businesses (Option ST2D)

Property Name	Description of Land-take	Loss of land		Sensitivity	Magnitude	Significance
		ha	%			
Private Property & Housing						
1 Station Cottages	Potential partial loss of garden from main alignment.	0.1	35	Very High/High	Moderate	**Very Large**
Auchlou Cottage	Demolition of building and potential partial loss of garden from main alignment.	0.1	59	Low	Major	**Moderate**
Rowanlea	Potential partial loss of woodland and garden from main alignment.	<0.1	10	Very High/High	Minor	**Large**
Glenlea (2 Station Cottages)	Partial loss of woodland from main alignment.	<0.1	<1	Very High/High	Negligible	Slight
Businesses						
Foster Contracting (North) Ltd (area also sub-let by Dunkeld Builders)	Potential demolition of two industrial buildings and one associated residential property.	0.5	91	Medium	Major	**Large**
Network Rail Infrastructure Ltd*	Potential partial loss of land (sidings) from main alignment and tie-in at A822 (Old Military Road), B867 and unclassified road to Inver.	1.2	n/a**	Very High/High	Minor	**Large**
Substation site by Birnam Industrial Estate	Relocation of electrical substation required.	<0.1	100	Very High/High	Major	**Very Large**
Aran Bakery	Potential demolition of commercial property from access to station car park.	0.1	100	Very High/High	Major	**Very Large**
Birnam Industrial Estate (including Lonely Mountain Skis Merriman Joinery, Dunkeld Plumbers and T&M Developments)	Potential loss of industrial estate including demolition of two industrial units for replacement station car park.	0.4	84	Very High/High	Major	**Very Large**

*potential impact on Dunkeld & Birnam Station is assessed under 'Community Assets'
**% area of loss has not been calculated due to the overall extent of the land interests land holdings.

8.4.137 The potential for significant effects has been identified for three houses and five businesses (one of which also includes one associated house) as a result of Option ST2D.

8.4.138 Potential impacts on viability of businesses are expected to be the similar to Option ST2A, with the exception that Ladywell Landfill would not be affected.

8.4.139 Whilst Option ST2D would not provide the same direct vehicular connection to Dunkeld & Birnam Station as Option ST2A and Option ST2B, there would be direct access from the station to Station Road, Birnam, Little Dunkeld and Dunkeld. This would be expected to have similar indirect beneficial impacts to Options ST2A and ST2B on the viability of business as a land use in these settlements.

8.4.140 In addition to the areas identified in Table 8.19, six housing/business areas would experience a change in vehicle accessibility when travelling to the A9 as a result of the Option ST2D. Expected change in vehicle access route for each housing/business area is outlined in Table 8.39 and illustrated on Figure 8.7. One journey would have the potential to experience significant effects on accessibility (Moderate).

Table 8.39: Private Property & Housing and Businesses Change in Vehicle Accessibility – to the North and South from the Properties (Option ST2D)

Housing/Business Area	Change in Journey Distance (km)		Significance		Figure Ref.
	North	South	North	South	
Byres of Murthly	+0.1	+0.3	Slight	Slight	8.7a-b
Murthly Estate	+0.3	+3.1	Slight	**Moderate**	8.7c-d
Properties at Ringwood	+0.1	+0.3	Slight	Slight	8.7e-f
Little Dunkeld and Birnam	+0.1	-<0.1	Slight	Slight (Beneficial)	8.7g-h
Properties at Birnam Glen	+0.1	-<0.1	Slight	Slight (Beneficial)	8.7i-j
Inver	+0.1	+<0.1	Slight	Slight	8.7m-n

8.4.141 In addition to the areas identified in Table 8.20, six housing/business areas would experience a change in accessibility when travelling to the housing/business areas from journeys originating in the north or the south as a result of Option ST2D. Expected change in access route for each housing/business area is outlined in Table 8.40 and illustrated on Figure 8.8. One journey would have the potential to experience significant (Moderate) effects on accessibility.

Table 8.40: Private Property & Housing and Businesses Change in Vehicle Accessibility – from the North and South to the Properties (Option ST2D)

Housing/Business Area	Change in Journey Distance (km)		Significance		Figure Ref.
	North	South	North	South	
Byres of Murthly	+0.1	-0.3	Slight	Slight (Beneficial)	8.8a-b
Murthly Estate	+0.3	+2.5	Slight	**Moderate**	8.8c-d
Properties at Ringwood	+0.1	-0.3	Slight	Slight (Beneficial)	8.8e-f
Little Dunkeld and Birnam	-<0.1	+0.1	Slight (Beneficial)	Slight	8.8g-h
Properties at Birnam Glen	-<0.1	+0.1	Slight (Beneficial)	Slight	8.8i-j
Inver	+0.3	-<0.1	Slight	Slight (beneficial)	8.8m-n

Community Assets

8.4.142 Option ST2D includes land-take from the existing Dunkeld & Birnam Station with partial loss of the existing parking area. Replacement car parking is provided, as part of the proposed route option design, from Station Road utilising the land currently occupied by the Birnam Industrial Estate. Pedestrian access to the station is proposed from this location via a pedestrian underpass and incorporating a lift allowing Equality Act 2010 compliant access to Platform 1 of Dunkeld & Birnam Station.

8.4.143 Users of Dunkeld & Birnam Station would experience a change in accessibility when travelling to the station from journeys originating in the north or the south with Option ST2D. Changes in accessibility would also be anticipated when travelling from the station to the A9. Expected change in accessibility for Dunkeld & Birnam Station is outlined in Table 8.41 and illustrated on Figure 8.7 and Figure 8.8.

Table 8.41: Dunkeld & Birnam Station Change in Vehicle Accessibility – to/from the North and South (Option ST2D)

Direction of travel	Change in Journey Distance (km)	Significance	Figure Ref.
To the north from the station	+0.1	Slight	8.7k
To the south from the station	+0.2	Slight	8.7l
From the north to the station	+0.1	Slight	8.8k
From the south to the station	+0.3	Slight	8.8l

8.4.144 Birnam Arts and Conference Centre would potentially see an increase in footfall and visitor numbers due to the connectivity of Dunkeld & Birnam Station with Station Road. This, combined with its improved connection to public transport links may result in an indirect beneficial impact from Option ST2D, supporting the continued land use and viability of the community asset as an events and conference centre.

Community Land

8.4.145 Potential impacts and effects on existing community land are expected to be the same as Option ST2A (refer to paragraphs 8.4.85 to 8.4.88) with the exception that Option ST2D would not facilitate the creation of new recreation space.

Development Land

8.4.146 Option ST2D would result in land-take from development land at Birnam Industrial Estate (Land allocation LA01) which is reported in Table 8.38. This has the potential to affect the development capacity of and accessibility to LA01 and overall, the potential for effects of Large significance is assessed.

8.4.147 In addition, Option ST2D is expected to result in changes in access to PA05. Changes in access to PA05 would be the same as that described for Dunkeld & Birnam Station in paragraph 8.4.142 to 8.4.143 and Table 8.41.

Agricultural Land Holdings

8.4.148 Option ST2D would potentially impact on five land interests resulting in total land-take from agricultural, forestry and sporting land of approximately 23.4ha, as shown in Table 8.42.

Table 8.42: Potential Impacts and Effects on Agricultural Land Holdings (Option ST2D)

Agricultural Holding Reference	Approximate Land-take (ha)				No. Fields	Magnitude	Significance
	Prime land	Non-prime land	Woodland	Total			
Forestry and Land Scotland	<0.1	0.4	8.6	9.0	15	Moderate	Slight
Atholl Estate	<0.1	0.3	0.3	0.6	13	Minor	Slight
Murthly Estate	0.5	2.0	7.6	10.1	16	Moderate	**Moderate**
Invermill Farm	0.0	0.6	0.1	0.7	4	Minor	Slight
Inchmagrannachan Farm	0.4	2.6	<0.1	3.0	2	Minor	Slight
Total	**0.9**	**5.9**	**16.6**	**23.4**	**50**		

8.4.149 The agricultural holdings listed in Table 8.42 would be affected by land-take and disruption to field boundary features, field access points and land drainage systems. In the case of Forestry and Land Scotland, Invermill Farm (land on the north side of the A9), and Inchmagrannachan farmland south of the River Tay Crossing, direct accesses from the A9 would be stopped up. This impact assessment has assumed that alternative access would be provided, and this would be developed at DMRB Stage 3.

8.4.150 The potential for effects of Moderate significance has been assessed for Murthly Estate. It is assessed that the combination of land-take and change in accessibility would not compromise viability for this agricultural holding and there would be no overall change in land use of the agricultural holding. The potential for effects of Slight significance have been assessed for the remaining agricultural holdings.

8.5 Potential Mitigation

8.5.1 For the DMRB Stage 2 assessment, the design has not been sufficiently developed to allow the mitigation measures to be defined in detail at this stage. The objective of this section is to identify potential mitigation taking into account best practice, legislation and guidance, which would be further developed and refined during the DMRB Stage 3 assessment.

Generic Construction Mitigation

8.5.2 Potential mitigation measures to reduce impacts on community and private assets in relation to construction include:

- restriction of construction activities to an agreed working corridor;
- restoring areas used for temporary construction compounds to previous use post-construction;
- introduction of traffic management/calming measures to help alleviate impacts on residential, commercial and industrial properties and on agricultural vehicle and machinery movements via the public road network;
- applying best-practice construction methods to reduce disturbance and consideration of timing of construction to avoid peak seasonal use if practicable; and
- protecting the sustainability of soils through compliance with the Construction Code of Practice for the Sustainable Use of Soils on Construction Sites (Defra, 2009).

8.5.3 Mitigation to reduce soils, water, landscape and visual, air quality and noise impacts on the local community and development land during construction is covered in more detail in Volume 1, Part 3 - Environmental Assessment (Chapter 9: Geology, Soils and Groundwater, Chapter 10: Road Drainage and

the Water Environment, Chapter 12: Landscape, Chapter 13: Visual, Chapter 15: Air Quality, and Chapter 16: Noise and Vibration).

Private Property & Housing and Businesses

8.5.4 Where vehicular access to private property & housing and businesses would be temporarily affected during construction, it is anticipated that reinstatement or an alternative access would be provided as part of design development and/or mitigation developed during the DMRB Stage 3 assessment.

8.5.5 The DMRB Stage 2 design for this project does not show the detail of revised access to individual residential, commercial or industrial properties alongside the A9, where properties currently have an access that would need to be stopped up as part of the dualling works (either stopping up of an individual direct access onto the A9, or of a side road which provides access). The details of revised access would be developed at DMRB Stage 3.

8.5.6 Potential mitigation to avoid or reduce impacts of land-take on gardens, woodland and parking areas would be developed further as part of the DMRB Stage 3 design. Example measures include design refinements to road layouts, refining tie-in points to the existing road network and measures to reduce the earthworks footprint including steeper slopes or retaining walls.

Community Assets

8.5.7 Mitigation for potential impacts and effects on community assets would be the same as for private property & housing and businesses as outlined in paragraphs 8.5.4 and 8.5.6.

8.5.8 Further consideration would be given to embedded mitigation to support links with public transport facilities such as bus stops and Dunkeld & Birnam Station and where practically possible, how this can be accessible for all users, including for vulnerable groups.

8.5.9 Options ST2C and ST2D include direct works within Network Rail land to provide station access for walkers and cyclists from Station Road and Birnam Industrial Estate via an underpass. Should either of these options be selected as the Preferred Route Option, further investigation would be undertaken to develop the design, if reasonably practicable, to allow inclusion of Equality Act 2010 compliant access facilities to both the northbound and southbound platforms of Dunkeld & Birnam Station. This could be, for example, to extend the pedestrian underpass to the northbound platform and would require liaison and agreement with Network Rail and Transport Scotland (Rail).

Community Land

8.5.10 Where land-take is required, resulting in the loss of all or part of land used by the community that is designated Open Space, the DMRB Stage 3 design would be developed to reduce land-take and consideration would be given to the need for provision of exchange land. Where the proposed scheme has the potential to create a new area of community land, the DMRB Stage 3 design would be developed to enhance this area for the community and support its designation as Open Space.

Development Land

8.5.11 Mitigation for potential impacts on development land identified as existing employment land (Birnam Industrial Estate and Foster Contracting (North) Ltd) would include reinstatement or provision of alternative access and DMRB Stage 3 design development to avoid or reduce land-take impacts for all proposed route options.

8.5.12 With regard to mitigation for potential impacts upon PA03, PA04, PA05, PA07and PA14, paragraph 8.5.6 states that mitigation to avoid or reduce impact on gardens and woodland would be developed further as part of DMRB Stage 3 design.

Agricultural Land Holdings

8.5.13 Mitigation measures with respect to agricultural holdings would be developed during the DMRB Stage 3 assessment with the aim of protecting, where practicable, the agricultural capability of land and soils and the maintenance of the viability of agricultural holdings.

8.5.14 Mitigation measures to avoid or reduce the effects on agricultural holdings are likely to include:

- providing access to farms, fields, forestry and water during and post construction;
- providing temporary and where appropriate, permanent fencing for the protection of the health and safety of the public and animals;
- reinstatement of soils, boundary features (fences, walls and hedges), water supplies and drainage systems;
- precautions to avoid the spread of soil borne pests and diseases, animal and crop diseases, tree diseases and invasive species; and
- arboriculture and/or wind throw assessments and any felling limited to that necessary to allow the safe construction and operation of the road.

8.5.15 In addition to the above mitigation measures, it may be appropriate to provide accommodation overbridges or underpasses to maintain access and reduce potential impacts.

8.5.16 Redundant man-made road features such as stopped up and severed road surfaces would be identified and in discussion with the landowner may be returned to them for their use or grubbed up and returned to agriculture.

8.6 Summary of Proposed Route Options Assessment

8.6.1 This section provides a summary of the assessment for the proposed route options taking into account the potential mitigation set out in Section 8.5 (Potential Mitigation). The potential for residual effects on private property & housing, businesses, community assets, community land, development land and agricultural holdings are discussed in the following paragraphs and a summary of assessment is provided in Table 8.43.

8.6.2 Two aspects are considered; the potential for residual effects considered significant in the context of the EIA Regulations, and whether the potential for impacts and effects differ sufficiently between proposed route options such that they can be considered a differentiator and need to be considered as part of the overall identification of the Preferred Route Option, which, as explained in Volume 1, Part 3 – Environmental Assessment (Chapter 7: Overview of Environmental Assessment), takes into account environmental, engineering, economic and traffic considerations.

8.6.3 A comparative assessment of all proposed route options during construction is shown in Table 8.45 which shows Options ST2C and ST2D have the potential for the lowest overall effects on private property & housing, businesses, community assets, community land, development land and agricultural holdings and Option ST2A the potential for the highest overall effects. Table 8.46 shows a comparative assessment of all proposed route options during operation which shows Option ST2A and Option ST2B have the potential for the lowest overall effects on private property & housing, businesses, community assets, community land, development land and agricultural holdings and Option ST2C and Option ST2D, the potential for the highest overall effects.

Construction

Private Property & Housing and Businesses

8.6.4 Option ST2A and Option ST2B are anticipated to affect the most groups of housing and businesses during construction of the proposed route options and Option ST2C and Option ST2D anticipated to affect the least number.

8.6.5 Option ST2A is anticipated to indirectly impact businesses for the longest duration (4.5 to 5 year construction period). Option ST2C and Option ST2D are anticipated to have the shortest construction period (2.5 to 3 years).

8.6.6 Option ST2A, Option ST2C and Option ST2D would require the acquisition of the Birnam Industrial Estate which includes five business tenants: Aran Bakery; Lonely Mountain Skis; Merriman Joinery; Dunkeld Plumbers; and T&M Developments. Option ST2B would only result in the relocation of one business (Aran Bakery).

8.6.7 The difference in the potential for effects on Private Property & Housing and Businesses is considered sufficient to be a differentiator between proposed route options and the comparative assessment is reported in Table 8.43.

Community Assets

8.6.8 All proposed route options would require the construction of Dunkeld Junction. In the case of Option ST2C which includes a grade separated junction at Dunkeld and necessitates the construction of large retaining walls, the works would be particularly close to community assets such as Craigvinean Surgery and Dunkeld and Birnam Recreation Club which would result in impacts such as temporary change in accessibility and potential reduction in use of the recreation club facilities.

8.6.9 Dunkeld & Birnam Station would remain open during construction of all proposed route options. Temporary access for pedestrians would be provided for all proposed route options during construction.

8.6.10 The difference in the potential for effects on Community Assets is considered sufficient to be a differentiator between proposed route options and the comparative assessment is reported in Table 8.43.

Community Land

8.6.11 For all proposed route options, the construction of the main alignment and the realigned B867 and Perth Road is anticipated to result in a temporary change in WCH accessibility and potential reduction in the level of use of Torwood Park. The construction of the left-in left-out junction which is proposed for all route options is also anticipated to result in temporary changes for vehicles and WCH, and a potential reduction in the level of use of The Hermitage.

8.6.12 Construction of the grade separated Dunkeld Junction for Option ST2C is anticipated to result in a temporary change in WCH accessibility and a potential reduction in the level of use of the Open Space at Riverside Land and Land by Little Dunkeld Manse.

8.6.13 The difference in potential for effects on Community Land is not considered sufficient to be a differentiator between proposed route options.

Development Land

8.6.14 For all proposed route options, construction impacts on PA05 would be the same as those described for Dunkeld & Birnam Station in paragraph 8.6.9. Option ST2C would also result in access impacts on PA14, which would be the same as those described for Dunkeld and Birnam Recreation Club in paragraph 8.6.8.

Agricultural Land Holdings

8.6.15 All proposed route options would require tree felling works at Murthly Estate due to the location of the construction compound for the construction of Murthly/Birnam Junction. There would be disturbance and change in access to Dalmarnock Fishings and Dunkeld House Salmon Fishings during construction, particularly the River Tay Crossing, removal of the A9 Southern Tie-in Interim Roundabout and the construction of the Dalguise Junction.

8.6.16 The difference in potential for effects on Agricultural Land Holdings is not considered sufficient to be a differentiator between proposed route options.

Operation

Private Property & Housing and Businesses

8.6.17 The assessment of private property & housing and businesses has identified a number of residual impacts and effects associated with the proposed route options as shown in Table 8.43. All proposed route options would require demolition of one house (Auchlou Cottage) due to online widening of the carriageway, and one house and two business buildings (Foster Contracting (North) Ltd) due to the proposed junction arrangement at Dunkeld. All proposed route options would also require the demolition of one business property (currently leased by Aran Bakery) to facilitate access to Dunkeld & Birnam Station as a result of online widening of the carriageway. The electricity substation would also require relocation for all proposed route options. All proposed route options would result in the partial loss of land from one business land interest (Network Rail Infrastructure Ltd) and two houses (1 Station Cottages and Rowanlea).

8.6.18 Birnam Industrial Estate would be acquired for Option ST2A, Option ST2C and Option ST2D. As a result, two business units within the industrial estate (Lonely Mountain Skis and Merriman Joinery) would be demolished, and two business yards within the industrial estate (Dunkeld Plumbers and T&M Developments) would be acquired.

8.6.19 Option ST2B and Option ST2D are expected to have the least land-take from private property & housing and businesses and Option ST2A the most. Option ST2A, Option ST2C and Option ST2D are anticipated to acquire and demolish the most buildings due to their impact on the Birnam Industrial Estate (refer to paragraph 8.6.6). Option ST2A, Option ST2C and Option ST2D are also anticipated to impact on viability of the greatest number of businesses.

8.6.20 Option ST2A is expected to have the potential for significant beneficial effects on vehicle accessibility for two groups of properties. Option ST2B, Option ST2C and Option ST2D would have the potential for significant effects on vehicle accessibility on the same number of properties but these would be adverse effects.

8.6.21 Accessibility to three telecommunications masts located on Forestry Commission land would result from all proposed route options.

8.6.22 The difference in the potential for effects on Private Property & Housing and Businesses is considered sufficient to be a differentiator between proposed route options and the comparative assessment is reported in Table 8.43.

Community Assets

8.6.23 All proposed route options would result in the potential loss of the existing parking area at the Dunkeld & Birnam Station. For all proposed route options new vehicular access to Dunkeld & Birnam Station and replacement car parking is incorporated in the proposed design via Station Road.

8.6.24 For all proposed route options, further development of detailed station access arrangements and station parking would be undertaken as part of the DMRB Stage 3 assessment, and it is therefore assumed that appropriate station access and parking would be provided. All proposed route options provide Equality Act 2010 compliant access to the southbound platform. In the case of Option ST2C and Option ST2D this access would be provided as part of the proposed scheme design through provision of an underpass and lift arrangement and further development of the DMRB Stage 3 design in conjunction with Network Rail and Transport Scotland (Rail) would investigate opportunities for improved accessibility to the northbound platform.

8.6.25 Option ST2A and Option ST2B would result in a change in journey length for Core Path DUNK/11 which provides access for residents at Birnam Glen to community assets located in Little Dunkeld. The change in journey length is not expected to result in the potential for significant effects.

8.6.26 The difference in the potential for effects on Community Assets, including their accessibility, is not considered sufficient to be a differentiator between the proposed route options.

Community Land

8.6.27 All proposed route options would result in potential land-take from Little Dunkeld Recreation Park, The Hermitage and Riverside Land. All proposed route options would also result in potential land-take from areas identified as Open Space (Little Dunkeld Recreation Park and Riverside Land) in the PKC LDP 2 and the need for provision for exchange land would be identified during the development of the DMRB Stage 3 design. For all proposed route options, the land-take and loss of amenity from the above community land interests are not expected to affect their use as recreation land and as a result, no potential significant effects are expected.

8.6.28 For Option ST2C, additional land-take from open amenity ground at Inchewan Burn would be required due to the creation of a SuDS basin and the extent of the land-take is assessed as having the potential to result in a significant effect.

8.6.29 Option ST2A has the potential to offset loss of community land and Open Space through creation of recreational land (assumed for the purposes of this assessment to be greenspace). The net gain in community land would be approximately 3.8ha. The design, the use, and the designation of this area would be considered further during the DMRB Stage 3 design process.

8.6.30 All proposed route options would result in the potential for significant effects on vehicle accessibility when travelling to The Hermitage for journeys originating in the north and when travelling from The Hermitage to the south via the A9.

8.6.31 All proposed route options would result in a journey change for Core Path DUNK/63 which provides access to The Hermitage from the east. The change in journey length is not anticipated to result in the potential for a significant effect.

8.6.32 The difference in potential for effects on Community Land is considered sufficient to be a differentiator between proposed route options and a comparative assessment is reported in Table 8.43.

Development Land

8.6.33 All proposed route options would have the potential to affect the development capacity of, and accessibility to, development land referenced as land allocation LA01 at Foster Contracting (North) Ltd as a result of land-take. Overall, the potential for an effect of Large significance is assessed.

8.6.34 Options ST2A, ST2C and ST2D are expected to result in the potential for effects of Large significance on LA01 at Birnam Industrial Estate as a result of land-take. This has the potential to affect the development capacity of, and accessibility to, LA01 (Birnam Industrial Estate). Option ST2B however, would not require land-take from businesses located within LA01 (Birnam Industrial Estate) and as such is not anticipated to affect the development capacity of and accessibility to the allocation. The potential for effects of Slight significance on LA01 (Birnam Industrial Estate) are assessed for Option ST2B.

8.6.35 Option ST2A and ST2B are expected to result in land-take from PA03, however this is not anticipated to affect the development capacity of the planning application. Option ST2A is also expected to result in land-take from PA04, with the potential for effects of Slight significance assessed. In addition, Option ST2C would result in land take from the boundary of PA07, however the potential for significant effects on the development capacity of the planning application are not expected. In addition, Option ST2C would result in land take from PA14, however, the potential for significant effects is assessed as Slight.

8.6.36 All proposed route options would have the potential to affect access to PA05, impacts would be the same as those described for Dunkeld & Birnam Station in paragraph 8.6.24.

8.6.37 The differences in the potential for effects on Development land are considered sufficient to be a differentiator between proposed route options and a comparative assessment is reported in Table 8.43.

Agricultural Land Holdings

8.6.38 Table 8.43 provides a summary of the potential impacts and effects on agricultural holdings after the proposed mitigation measures identified in paragraphs 8.5.13 to 8.5.16 have been employed. This includes a summary of total land-take (as prime and non-prime agricultural land), the number of agricultural holdings potentially affected and the number of agricultural holdings with the potential for effects of Moderate significance or above.

8.6.39 All proposed route options are expected to result in land-take from non-prime and prime agricultural land and woodland. Additional impacts across the proposed route options include disruption to access (to agriculture, forestry and sporting land), disturbance (loss of and disturbance to boundary features, land drainage systems and fishing) and severance, including from key infrastructure.

8.6.40 The access provisions developed as part of the DMRB Stage 3 assessment would restore access to agricultural land and woodland at Forestry and Land Scotland, Invermill Farm (land on the north side of the A9), and Inchmagrannachan farmland south of the River Tay Crossing.

8.6.41 The potential for effects of Moderate significance has been assessed for Murthly Estate for all proposed route options. The potential for effects of Slight significance have been assessed for the remaining agricultural holdings.

8.6.42 In addition, all proposed route options would have the potential for effects of Moderate significance on Dalmarnock Fishings associated with change in access for journeys between the fishing beat (upper beat to lower beat).

8.6.43 The differences between the proposed route options with regards to agricultural holdings are not considered sufficient to be a differentiator between the proposed route options.

Table 8.43: Summary of Assessment – Population: Land Use

Chapter/Subcategory			Residual Impacts and Effects				Comments
			Option ST2A	Option ST2B	Option ST2C	Option ST2D	
Population – Land Use	Construction	Private Property & Housing and Businesses	Disruption to 9 groups of housing and businesses properties as a result of construction activities. Indirect impacts on businesses in Dunkeld, Birnam and Inver during the 4.5 – 5-year construction period.	Disruption to 9 groups of housing and businesses properties as a result of construction activities. Indirect impacts on businesses in Dunkeld, Birnam and Inver during the 4 – 4.5-year construction period.	Disruption to 8 groups of housing and businesses properties as a result of construction activities. Indirect impacts on businesses in Dunkeld, Birnam and Inver during the 2.5 - 3-year construction period.	Disruption to 8 groups of housing and businesses properties as a result of construction activities. Indirect impacts on businesses in Dunkeld, Birnam and Inver during the 2.5 - 3-year construction period.	The differences in impacts and effects on businesses as a result of construction are considered sufficient to be a differentiator between the proposed route options.
		Community Assets	Footfall at Birnam Arts and Conference Centre may be affected, particularly for passing trade and tourist visitors.	Footfall at Birnam Arts and Conference Centre may be affected, particularly for passing trade and tourist visitors.	Craigvinean Surgery and Dunkeld and Birnam Recreation Club would experience impacts such as temporary change in access and potential reduction in use of the recreation club facilities. Footfall at Birnam Arts and Conference Centre may be affected, particularly for passing trade and tourist visitors.	Footfall at Birnam Arts and Conference Centre may be affected, particularly for passing trade and tourist visitors.	The differences in impacts and effects on community assets are considered sufficient to be a differentiator between the proposed route options.
		Community Land	Temporary change in accessibility and potential reduction in the level of use of Torwood Park and The Hermitage.	Temporary change in accessibility and potential reduction in the level of use of Torwood Park and The Hermitage.	Temporary change in accessibility and potential reduction in the level of use of Torwood Park, The Hermitage and Riverside Land.	Temporary change in accessibility and potential reduction in the level of use of Torwood Park and The Hermitage.	The differences in impacts and effects on community land are not considered sufficient to be a differentiator between the proposed route options.
		Development Land	Temporary change in access to PA05.	Temporary change in access to PA05.	Temporary change in access to PA05 and PA14.	Temporary change in access to PA05.	The differences in impacts and effects on development land are not considered sufficient to be a differentiator between the proposed route options.

Chapter/Subcategory			Residual Impacts and Effects				Comments
			Option ST2A	Option ST2B	Option ST2C	Option ST2D	
Population – Land Use	Construction	Agricultural Holdings	Requirement of tree felling works at Murthly Estate due to the location of the construction compound for Murthly Junction. Disturbance to two agricultural holdings (fishing).	Requirement of tree felling works at Murthly Estate due to the location of the construction compound for Birnam Junction. Disturbance to two agricultural holdings (fishing).	Requirement of tree felling works at Murthly Estate due to the location of the construction compound for Birnam Junction. Disturbance to two agricultural holdings (fishing).	Requirement of tree felling works at Murthly Estate due to the location of the construction compound for Birnam Junction. Disturbance to two agricultural holdings (fishing).	The differences in impacts and effects on agricultural holdings are not considered sufficient to be a differentiator between the proposed route options.
	Operation	Private Property & Housing and Businesses	14 land interests affected by land-take of which 8 have the potential for significant effects. **Approx. land-take 2.8ha.** Of these land interests, two houses, two business buildings, two industrial units and one business property would be demolished. **Total demolitions: 7** Relocation of an electrical substation. 6 businesses with impacts on viability. The potential for 2 significant beneficial effects arising from changes in vehicle journey distance.	13 land interests affected by land-take of which 8 have the potential for significant effects. **Approx. land-take 2.3ha.** Of these land interests, two houses, two business buildings and one business property would be demolished. **Total demolitions: 5** Relocation of an electrical substation. 3 businesses with impacts on viability. The potential for 2 significant effects arising from changes in vehicle journey distance.	9 land interests affected by land-take of which 8 have the potential for significant effects. **Approx. land-take 2.6ha.** Of these land interests, two houses, two business buildings, two business units and one business property would be demolished. **Total demolitions: 7** Relocation of an electrical substation. 6 businesses with impacts on viability. The potential for 2 significant effects arising from changes in vehicle journey distance.	9 land interests affected by land-take of which 8 have the potential for significant effects. **Approx. land-take 2.3ha.** Of these land interests, two houses, two business buildings, two business units and one business property would be demolished. **Total demolitions: 7** Relocation of an electrical substation. 6 businesses with impacts on viability. The potential for 2 significant effects arising from changes in vehicle journey distance.	The differences in impacts and effects on private property & housing and businesses are considered sufficient to be a differentiator between the proposed route options.

Chapter/Subcategory			Residual Impacts and Effects				Comments
			Option ST2A	Option ST2B	Option ST2C	Option ST2D	
Population – Land Use	Operation	Community Assets	Replacement of car parking at Dunkeld & Birnam Station and direct connection to Station Road for vehicles and WCH. Access to southbound platform would be Equality Act 2010 compliant. Change in accessibility to community assets via Core Path DUNK/11 (Path 28).	Replacement of car parking at Dunkeld & Birnam Station and direct connection to Station Road for vehicles and WCH. Access to southbound platform would be Equality Act 2010 compliant. Change in accessibility to community assets via Core Path DUNK/11 (Path 28).	Replacement of car parking at Dunkeld & Birnam Station on site of Birnam Industrial Estate. Access to southbound platform would be Equality Act 2010 compliant.	Replacement of car parking at Dunkeld & Birnam Station on site of Birnam Industrial Estate. Access to southbound platform would be Equality Act 2010 compliant.	The differences in impacts and effects on community assets are not considered sufficient to be a differentiator between the proposed route options.
		Community Land	Approx. 0.2ha land-take of which 0.1ha designated Open Space. Potential for creation of a new recreational area (greenspace) for use by the local community. Net gain of 3.8ha in community land. Change in accessibility to community land via Core Path DUNK/63 (Path 41). The potential for 2 significant effects arising from changes in vehicle journey distance.	Approx. 0.2ha land-take of which 0.1ha designated Open Space. Change in accessibility to community land via Core Path DUNK/63 (Path 41). The potential for 2 significant effects arising from changes in vehicle journey distance.	Approx. 0.7ha land-take of which 0.3ha designated Open Space. Change in accessibility to community land via Core Path DUNK/63 (Path 41). The potential for 2 significant effects arising from changes in vehicle journey distance.	Approx. 0.2ha land-take of which 0.1ha designated Open Space. Change in accessibility to community land via Core Path DUNK/63 (Path 41). The potential for 2 significant effects arising from changes in vehicle journey distance.	The differences in impacts and effects on community land are considered sufficient to be a differentiator between the proposed route options.
		Development Land	Potential impact on development capacity of land allocation LA01 at Foster Contracting (North) Ltd and Birnam Industrial Estate. Land-take from 2 planning applications (PA03 and PA04). Change in access to 1 planning application (PA05)	Potential impact on development capacity of land allocation LA01 at Foster Contracting (North) Ltd. Land-take from 1 planning application (PA03). Change in access to 1 planning application (PA05).	Potential impact on development capacity of land allocation LA01 at Foster Contracting (North) Ltd and Birnam Industrial Estate. Land take from 2 planning application (PA07 and PA14). Change in access to 1 planning application (PA05).	Potential impact on development capacity of land allocation LA01 at Foster Contracting (North) Ltd and Birnam Industrial Estate. Change in access to 1 planning application (PA05).	The differences in impacts and effects on development land are considered sufficient to be a differentiator between the proposed route options.

Chapter/Subcategory			Residual Impacts and Effects				Comments
			Option ST2A	Option ST2B	Option ST2C	Option ST2D	
Population – Land Use	Operation	Agricultural Land Holdings	Potential for effects on 7 agricultural holdings of which 1 is considered significant: Murthly Estate (Moderate). Change in access for Dalmarnock Fishings for journeys from the upper beat to the lower beat and fishing bothy (Moderate). Land-take of 0.9ha prime and 7.0ha non-prime agricultural land and 20.4ha of woodland. **Total land-take:** **28.3ha**	Potential for effects on 7 agricultural holdings of which 1 is considered significant: Murthly Estate (Moderate). Change in access for Dalmarnock Fishings for journeys from the upper beat to the lower beat and fishing bothy (Moderate). Land-take of 0.9ha prime and 6ha non-prime agricultural land and 17.5ha of woodland. **Total land-take:** **24.4ha**	Potential for effects on 7 agricultural holdings of which 1 is considered significant: Murthly Estate (Moderate). Change in access for Dalmarnock Fishings for journeys from the upper beat to the lower beat and fishing bothy (Moderate). Land-take of 1.0ha prime and 5.9ha non-prime agricultural land and 18.7ha of woodland. **Total land-take:** **25.6ha**	Potential for effects on 5 agricultural holdings of which 1 is considered significant: Murthly Estate (Moderate). Change in access for Dalmarnock Fishings for journeys from the upper beat to the lower beat and fishing bothy (Moderate). Land-take of 0.9ha prime and 5.9ha non-prime agricultural land and 16.6ha of woodland. **Total land-take:** **23.4ha**	The differences in impacts and effects on agricultural land holdings are not considered sufficient to be a differentiator between the proposed route options.

Compliance Against Plans and Policies

8.6.44 DMRB LA 104 states that environmental assessment, reporting and monitoring shall meet the requirements of the national planning policy for each relevant Overseeing Organisation.

8.6.45 *Appendix A21.1 (Assessment of Policy Compliance)* provides a review of national and local policy documents which are of relevance to this assessment undertaken and reported in this chapter in accordance with DMRB guidance.

8.6.46 National Planning Policy objectives (and accompanying best practice guidance) of relevance to this assessment are provided in National Planning Framework 3 (Scottish Government, 2014b), Scottish Planning Policy (SPP) (Scottish Government, 2014a) themes Sustainability, Placemaking, Supporting Business & Employment, Valuing the Natural Environment and Maximising the Benefits of Green Infrastructure. In addition to Perth and Kinross Local Development Plan 2 (PKC LDP2) Policies 7 (Employment and Mixed-Use Areas), 8 (Rural Business and Diversification), 9 (Caravan Sites, Chalets and Timeshare Developments), 14 (Open Space Retention and Provision), 16 (Social, Cultural and Community Facilities), 17 (Residential Areas), 50 (Prime Agricultural Land) and 51 (Soils). TAYplan Policies 2 (Shaping Better Quality Places) and 9 (Managing TAYplan's Assets) are also of relevance.

8.6.47 A full policy compliance assessment can be found in Table 1 of *Appendix A21.1 (Assessment of Policy Compliance)*. It is assessed that there is potential for non-compliance with policy objectives and local designations. Further assessment would be undertaken at DMRB Stage 3 which would consider design development and environmental mitigation, which reduce impacts and improve the likelihood of policy compliance.

Community Objectives

8.6.48 The community objectives (refer to Volume 1, Part 3 - Environmental Assessment (Chapter 7: Overview of Environmental Assessment, Table 7.2)) have been considered throughout DMRB Stage 2. *Appendix A7.1: Mapping of Community Objectives Against DMRB Stage 2 Route Options* sets out which DMRB Stage 2 environmental topics are relevant to each of the Objectives.

8.6.49 *Appendix A7.1: Mapping of Community Objectives Against DMRB Stage 2 Route Options* confirms that community objectives 1, 3, 4, 6 and 7 are relevant to the assessment of Population - Land Use. Professional judgement has been used to consider how the proposed route options contribute to these objectives for the operation phase, as summarised in Table 8.44.

8.6.50 Option ST2A is considered to contribute to most of the objectives due to the potential for creation of new amenity space on top of the cut and cover tunnel, which particularly addresses most of Objectives 1 and 5. All other proposed route options are considered to contribute in part as there are benefits and adverse impacts for each.

8.6.51 The contribution of the operation phase of each of the proposed route options to the relevant community objectives was categorised, using professional judgement and in accordance with the following key.

Contributes to all/most of the community objective

Contributes to part of the community objective

Contributes to little/none of the community objective

Table 8.44: Contribution to community objectives during operation for this environmental topic

Relevant Community Objective		Option ST2A	Option ST2B	Option ST2C	Option ST2D
1	Reduce current levels of noise and pollution in the villages of Dunkeld, Birnam and Inver to protect human health and well-being of residents and visitors and to enable them to peacefully enjoy their properties and amenity spaces.				
3	Provide better, safer access on and off the A9 from both sides of the road while ensuring easy, safe movement of vehicular traffic and NMUs through the villages, helping to reduce stress and anxiety and support the local community.				
4	Promote long-term and sustainable economic growth within Dunkeld and Birnam and the surrounding communities.				
6	Ensure that all local bus, intercity bus services and train services are maintained and improved.				
7	Preserve and enhance the integrity of the unique and rich historical and cultural features of the Dunkeld, Birnam and Inver communities, thereby supporting well-being and the local economy.				

8.6.52 In relation to objective 1, Table 8.44 indicates that Option ST2A contributes to a reduction in levels of noise and air pollution in the villages during operation. This is largely due to option ST2A being in a cut and cover tunnel which would also provide an opportunity to create new recreational space on top of the cut and cover tunnel, which the other proposed route options do not.

8.6.53 Post construction, all proposed route options contribute to objective 3 as they would provide safe access to the A9 for motorised users via the proposed junctions. Accessibility for WCH would be maintained, albeit some routes would be diverted as a result of the proposed route options.

8.6.54 Objective 4 is partly met by all proposed route options. Traffic is predicted to increase on the A9 which would increase the number of visitors to the communities, positively affecting the local economy. The local area would benefit from improved links to other towns and cities, from both the A9 itself and from the improved connection to Dunkeld & Birnam Station. The changes at Birnam Industrial Estate, including the demolition of buildings for all proposed route options explain why this Objective is not fully met.

8.6.55 For objective 6, specific consideration of bus stops within the proposed scheme would be considered as part of the DMRB Stage 3 assessment.

8.6.56 All proposed route options are considered to have a benefit to economic growth and perceptions of the local area during operation. Traffic is predicted to increase on the A9 and would therefore bring an increase in the number of visitors to the communities, providing a boost to the local economy thus contributing to objective 7.

Comparative Assessment

8.6.57 The differences between proposed route options for impacts and effects assessed during construction on agricultural holdings are not considered sufficient to be a differentiator between proposed route options. However, differentiation has been possible between the options on duration and complexity of the construction period, the number of groupings of housing and businesses properties affected and consequently the potential for direct and indirect impacts on businesses and community assets during construction.

8.6.58 It is considered that Option ST2A would have the highest overall effect during construction on Population - Land Use. Option ST2B is expected to have intermediate effect due to the second longest construction period (4 to 4.5 years) with similar consequential effects on Population - Land Use as Option ST2A.

8.6.59 Options ST2C and ST2D are anticipated to have the lowest overall effect for Population - Land Use, as shown in Table 8.45.

Table 8.45: Population – Land Use Comparative Assessment – Construction

Route Option	Lowest Overall Effect	Intermediate Overall Effect	Highest Overall Effect
Option ST2A			✓
Option ST2B		✓	
Option ST2C	✓		
Option ST2D	✓		

8.6.60 During operation, the differences in impacts and effect on community assets, accessibility to community assets and agricultural holdings are not considered sufficient to be a differentiator between proposed route options. Due to the demolitions, potential loss of Birnam Industrial Estate and potential impact on the development capacity of Birnam Industrial Estate, Options ST2C and ST2D are considered to have the highest overall effect.

8.6.61 Option ST2A and Option ST2B are expected to have intermediate overall effects during operation with Option ST2A potential adverse impacts arising from property demolitions and impacts on Birnam Industrial Estate balanced by the beneficial impacts associated with the potential for creation of community land (greenspace).

8.6.62 During operation, Option ST2A and Option ST2B are assessed as having the lowest overall effects and Option ST2C and ST2D the highest overall effects, as shown in Table 8.46.

Table 8.46: Population – Land Use Comparative Assessment – Operation

Route Option	Lowest Overall Effect	Intermediate Overall Effect	Highest Overall Effect
Option ST2A	✓		
Option ST2B	✓		
Option ST2C			✓
Option ST2D			✓

8.7 Scope of DMRB Stage 3 Assessment

8.7.1 It is proposed that the Stage 3 assessment for Population - Land Use would be undertaken in accordance with the DMRB. It is anticipated the DMRB Stage 3 assessment would include the following:

- detailed consideration of properties at risk of demolition or land-take including consideration of likely effect on viability;
- consideration of effects on community assets and access and parking arrangements for Dunkeld & Birnam Station;
- further consultation to identify community land including any areas of importance for informal use and need for exchange land;
- review of any new planning applications or changes in the status of applications previously identified. The local planning authority would be asked to give its views on how the Preferred Route Option may affect its development designations;
- input into scheme design and development of specific access provisions to affected private property & housing, businesses, development land and agricultural holdings;
- consideration of opportunities for land to be returned to agriculture;
- development of mitigation proposals for agricultural holdings to reduce impacts of land-take, husbandry, severance, boundary impacts and operational disruption;
- consultation with affected land owners and occupiers and assessment of impacts updated; and
- where significant impacts are identified, an assessment of the impact of the proposed scheme on viability.

8.8 References

Legislation

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9. Geology, Soils and Groundwater

9.1 Introduction

9.1.1 This chapter presents the Design Manual for Roads and Bridges (DMRB) Stage 2 assessment of the proposed route options in relation to the impacts on geology, soils and groundwater. This includes impacts and effects to superficial and bedrock geology, soils, land contamination and groundwater (including groundwater reliant receptors such as private water supplies (PWS), ecological habitats and surface water features).

9.1.2 The chapter is supported by the following appendices, which are cross-referenced where relevant:

- Appendix A9.1: Potential Sources of Land Contamination within Study Area;
- Appendix A9.2: Ladywell Landfill;
- Appendix A9.3: Land Contamination Risk Assessment; and
- Appendix A9.4: Surface Water Indirect Dewatering Assessment.

9.1.3 Geological impacts can occur due to excavating or masking exposures of rocks or superficial geological deposits of particular scientific interest, particularly if the features of interest are not reproduced elsewhere in the area. Impacts can also include restrictions on existing or potential commercial exploitation of resources, and conversely previous exploitation of resources can impose constraints on proposed route options; for example, where land has become unstable due to mining or has been contaminated by previous land uses. It is also recognised that rock exposures can deliver environmental benefit, such as improved access to, and exposure of, new areas of geological interest. Soil impacts include the potential loss of valuable or rare soil resources as a result of land take or soil reduction required for the proposed route options.

9.1.4 During construction, there is an inherent risk of spillage or leakage of fuel or oil from storage tanks or construction plant. Without suitable mitigation measures, these pollutants could enter aquifers and degrade water quality. Construction work can lead to dewatering and to contamination of superficial and bedrock aquifers.

9.1.5 Similarly, once a new road is opened, runoff from the road surface may contain elevated concentrations of pollutants, such as oils, suspended solids, metals and, in winter, salt and engine coolants (e.g. ethylene glycol), which may find their way into the groundwater system. Groundwater flows can also be intercepted or altered by new cuttings and other significant changes to landform.

Legislative and Policy Background

9.1.6 The assessment takes cognisance of relevant legislation, policy, guidance and regulations including those listed in Table 9.1. Relevant documents will be referred to throughout this chapter and all will be noted in the references (Section 9.8).

Table 9.1: Key Legislation, Policy, Guidance and Regulation

Topic	Name of Relevant Legislation, Policy, Guidance and Regulation
Legislation	The Roads (Scotland) Act 1984 (Environmental Impact Assessment) Regulations 2017 (Scottish Statutory Instrument, 2017a); EU Water Framework Directive (2000/60/EC) (European Parliament, 2000); Groundwater Daughter Directive (2006/118/EC) (European Parliament, 2006); Water Environment Water Services (WEWS Act) (Scotland) Act 2003 (Scottish Statutory Instrument, 2003); The Water Environment (Controlled Activities) (Scotland) Regulations 2011 (as amended) (CAR) (Scottish Statutory Instrument, 2011a); The Water Environment (Miscellaneous) (Scotland) Regulations 2017 (Scottish Statutory Instrument, 2017b); Environment Act 1995 (UK Government, 1995); Part IIA of the Environmental Protection Act 1990 (UK Government, 1990); The Contaminated Land (Scotland) Regulations 2005 (Scottish Statutory Instrument, 2005); and The Waste Management Licensing (Scotland) Regulations 2011 (as amended by the Waste Management Licensing (Scotland) Amendment Regulations 2016) (Scottish Statutory Instrument, 2011).
Policy	The Scottish Soil Framework (Scottish Government, 2009); Water Framework Directive (WFD) policy guidance 'The Future for Scotland's Waters: Guiding Principles on the Technical Requirements of the Water Framework Directive' (SEPA, 2002); Scottish Planning Policy (SPP), A Natural, Resilient Place, Managing Flood Risk and Drainage (Scottish Government, 2014a; Revised 2020); and Planning Authority Protocol (Policy 41) Development at Risk of Flooding: Advice and Consultations (SEPA, 2016a).
Key Guidance and Standards	DMRB LA 104 'Environment assessment and monitoring', Revision 1 (Highways England et al., 2020a), hereafter referred to as DMRB LA 104; DMRB LA 109 'Geology and soils', Revision 0 (Highways England et al., 2019), hereafter referred to as DMRB LA 109; DMRB LA 113 'Road drainage and the water environment', Revision 1 (Highways England et al., 2020b), hereafter referred to as DMRB LA 113; Construction Code of Practise for the Sustainable Use of Soils on Construction Sites (Department for Environment, Food and Rural Affairs (Defra), 2009); Position Statement (WAT-PS-10-01) (SEPA, 2014a); Supporting Guidance (WAT-SG-53) (SEPA, 2020); The Water Environment (Controlled Activities) (Scotland) Regulations 2011 (as amended) A Practical Guide (SEPA, 2019); Regulatory Method (WAT-RM-11) (SEPA 2017a); Land Use Planning System (LUPS) Guidance Note 31 (SEPA, 2017b); CIRIA Report C532: Control of water pollution from construction sites (CIRIA, 2001a); CIRIA Report C552: Contaminated Land Risk Assessment: A guide to good practice (CIRIA, 2001b); Land contamination risk management (LCRM) (Environment Agency, 2020); British Standard Code of Practice for the investigation of potentially contaminated sites (BS 10175:2011 + A2:2017) (BSI, 2017); Planning Advice Notice (PAN) 33 Development of Contaminated Land (Scottish Executive, 2017); Environmental Protection Act 1990: Part IIA Contaminated Land Statutory Guidance: Edition 2 (Scottish Executive, 2006); and Environmental Protection Act 1990: Part 2A - Contaminated Land Statutory Guidance (DEFRA, 2012).

9.2 Approach and Methods

Scope and Guidance

9.2.1 This assessment has been undertaken following DMRB LA 109 and DMRB LA 113. The guidance within DMRB LA 104 has also influenced the approach and methods undertaken for this assessment.

9.2.2 The baseline for geology, soils and groundwater includes information pertaining to the occurrence of peat and mineral resources within the study area to provide context for the Geology, Soils and Groundwater assessment. An assessment of effects on peat as a carbon rich soil is presented within this chapter. However, the assessment of effects on peat as a material asset and on mineral resources are presented within Volume 1, Part 3 - Environmental Assessment (Chapter 18: Material Assets and Waste). There are no peat habitats identified within the study area.

9.2.3 Considerations of the proposed route options in the context of national, regional and local planning policies in this DMRB Stage 2 assessment are covered in Volume 1, Part 3 - Environmental Assessment (Chapter 21: Policies and Plans) and *Appendix A21.1 (Assessment of Policy Compliance).*

Study Area

9.2.4 The assessment study area extends 250 m from the proposed route options as shown on Figures 9.1 to 9.4. DMRB LA 109 does not specify a study area, stating that it should be based on project specific considerations. The addition of the 250 m buffer is based on the Guidance for the Safe Development of Housing on Land Affected by Contamination (National House Building Council and Environment Agency 2008). As such, the assessment study area is a conservative, but a sensible approach in the context of the proposed route options, taking into account the distance over which contamination can migrate.

9.2.5 In accordance with DMRB LA 113, and as agreed with the Scottish Environment Protection Agency (SEPA), the study area for the consideration of Groundwater Dependant Terrestrial Ecosystems (GWDTE) extended 100 m from the existing A9 with the option to extend this boundary should the dewatering impact assessment require so.

9.2.6 The study area for groundwater abstractions have been assessed to a distance of 850 m from the proposed route options in accordance with the minimum study area to be applied for groundwater abstraction licensing under The Water Environment (Controlled Activities) (Scotland) (Regulations) 2011 (as amended) (Scottish Government, 2011a).

Baseline Data Collection

9.2.7 Baseline conditions were determined through a desk-based data review and assessment and consultation with statutory and non-statutory bodies.

9.2.8 Baseline conditions cover the following aspects of ground conditions:

- soil resources;
- superficial and bedrock geology;
- features of geological importance;
- mineral extraction;
- groundwater environment, including PWS, GWDTE and base flow to surface water features; and
- land contamination.

Desk-based Assessment

9.2.9 The desk-based assessment included a review of the following information:

- British Geological Survey (BGS) data including BGS Superficial and Bedrock Geological Maps, BGS Hydrogeological Map of Scotland (BGS, 1988a), BGS Groundwater Vulnerability Map (BGS, 1988b), BGS Geoindex (BGS 2021) and other relevant BGS publications.
- Macaulay Institute for Soil Research, Soil Survey of Scotland Map, Sheet 5, Eastern Scotland, 1981 viewed on the UK Soil Observatory Soils Map Viewer (UK Soil Observatory, 2021).
- Landmark Envirocheck Report (Landmark 2015).
- Ordnance Survey (OS) historical maps dating back to 1866 for information on former land use, any potential contamination and physical hazards and information on PWS (Landmark Information Group, 2015).
- SEPA interactive Water Environment Hub (SEPA 2021a) and the SEPA interactive Water Classification Hub (SEPA, 2021b).
- NatureScot SNHi data services. (NatureScot 2020).
- Scottish Natural Heritage[1] (SNH) (2016) Carbon-rich soils, deep peat and priority peatland habitat mapping, Consultation analysis report as viewed on Scotland's Soil Map Viewer (Scotland's Soils, 2021).
- Previous Assessments:
  - AECOM, A9 Dualling: Pass of Birnam to Tay Crossing Ground Investigation Report Final Revision 03 (AECOM, 2016).
  - Scott Wilson, A9 Pass of Birnam to Tay Crossing Preliminary Sources Study Report (Scott Wilson, 2011).
  - Jacobs, A9 Dualling Perth to Inverness, Geotechnical Preliminary Sources Study Report, Tay Crossing to Pitlochry, Chainage 22800 to 36300m (Jacobs, 2013a)
  - Jacobs, A9 Dualling Perth to Inverness, Geotechnical Preliminary Sources Study Report, Birnam, Chainage 13000 to 14700m (Jacobs, 2013b)
  - Transport Scotland, A9 Route Improvement Strategy - Dualling of Birnam to Tay Crossing, Stage 2 Options Assessment Report, Part 2 Environmental Assessment, Volume 1 Environmental Report, Volume 2 Figures, Volume 3 Appendix, June 2011 (Transport Scotland, 2011).
  - Transport Scotland A9 Dualling Programme: Strategic Environmental Assessment (SEA) (Transport Scotland 2013, 2014a and 2014b).

Consultation

9.2.10 A summary of the consultation is reported in Volume 1, Part 3 - Environmental Assessment (Chapter 7: Overview of Environmental Assessment, Section 7.6 (Consultation)). Key consultations that have informed this assessment are summarised in the following paragraph.

9.2.11 Consultations have been undertaken with a number of statutory and non-statutory bodies. These include the following:

- SEPA for information on licenced groundwater abstractions (via The Water Environment (Controlled Activities) (Scotland) Regulations 2011) (as amended) (Scottish Government 2011a) and on former and current contaminated land use;

[1] In August 2020, Scottish Natural Heritage (SNH) was rebranded and is now known as NatureScot.

- NatureScot for information on the location and extent of environmental sensitivities in the vicinity of the proposed route options and to establish any future development constraints;
- Perth & Kinross Council (PKC) for information on former and current contaminated land use, past and present operational management of Ladywell Landfill, PWS, licenced fuel storage and any additional relevant information; and
- Private property/landowners to identify the presence of septic tanks and PWS and obtain information on water source location and type, water storage, treatment and intended use.

Walkover

9.2.12 A site walkover was undertaken on 13 September 2018 to obtain further information on Ladywell Landfill. No other site walkover surveys were considered necessary to differentiate between the proposed route options in relation to potential impacts on geology, contaminated land and groundwater features.

Ground Investigation

9.2.13 Four phases of Ground Investigation (GI) associated with the A9 Dualling project have been undertaken within the study area as detailed in Table 9.2. The first was designed by AECOM and undertaken in 2014/2015 by Soil Engineering Geoservices Limited (SEGL, 2015). The three subsequent GI were designed by Jacobs and undertaken by Fugro Geoservices Limited (Fugro, 2016a and b; Fugro, 2017; and Fugro, 2018). In addition, further GI data and subsequent monitoring data associated with Ladywell Landfill has been provided by PKC as detailed within *Appendix A9.2: Ladywell Landfill.* Relevant data gathered from all GI have informed this assessment.

Table 9.2: Ground Investigation Timeline and Summary

GI Phase	SEGL 2015	Advanced GI		Preliminary GI	Detailed GI
Designer	AECOM	Jacobs			
Drilling Contractor	Soil Engineering Geoservices Limited (SEGL)	Fugro Geoservices Limited (Fugro)			
Date Undertaken	June 2014 - February 2015	August - December 2015		October - December 2016	February - April 2018
Total No. of Boreholes	310	6	47 (7 within study area)	19 (8 within study area)	80 (16 within study area)
Cable Percussion	275	0	37	12	30
Rotary	146 (111 follow on from Cable Percussive)	1 (follow on from Sonic Drilled)	2	2	15
Sonic Drilled	0	6	8	5	35 (1 follow on from Cable Percussive)
Boreholes available for Groundwater and/or Gas Monitoring	65	6	28 (4 within study area)	11 (3 within study area)	44 (9 within study area)
Trial Pits	192	0	0	12 (4 within study area)	55 (11 within study area)

GI Phase	SEGL 2015	Advanced GI		Preliminary GI	Detailed GI
Laboratory Testing	Alcontrol Laboratories	Derwentside Environmental Testing Services			
	Completed in November 2015	Completed in January 2016	Completed in February 2016	Completed in February 2017	Completed in May 2018
Report Reference	SEGL (2015)	Fugro (2016a)	Fugro (2016b)	Fugro (2017)	Fugro (2018)

Assessment of Impacts and Effects

9.2.14 The assessments reported in this chapter have been undertaken in accordance with the guidance provided in DMRB LA 104, DMRB LA 109 and DMRB LA 113 whereby the level of significance of a potential effect on the existing baseline condition is determined by the value/importance of the receptor/attribute, combined with the magnitude of impact. The criteria outlined in Table 9.3 and Table 9.4 are based on those that have been applied to similar schemes in Scotland and are designed to comply with DMRB guidance.

9.2.15 In relation to soils, appreciation has been given to potential soil conservation value and rarity based on professional judgement, as well as the SNH Carbon and Peatland Map (SNH, 2016) and the Macaulay Land Capability for Agriculture (LCA) Classification Scheme (James Hutton Institute, 2016).

9.2.16 Impacts on groundwater quality and/or flow may also have direct or indirect effects on groundwater abstractions, ecological receptors with potential groundwater dependency and surface water features. The groundwater assessment is undertaken within the context of the Water Framework Directive (WFD) (2000/60/EC) (European Parliament, 2000) which was transposed into Scottish law under the Water Environment and Water Services (Scotland) Act 2003 (Scottish Government, 2003), and the Groundwater Daughter Directive (2006/118/EC) (European Parliament, 2006).

9.2.17 In compliance with DMRB LA 109 a desk study has been undertaken to identify potential sources of contamination associated with current and historical land uses, and pathways to receptors in accordance with Land contamination risk management (LCRM) (Environment Agency 2020) and BS 10175:2011 + A2:2017 (BSI 2017). This desk study and land contamination risk assessment is presented within three appendices: *Appendix A9.1 (Potential Sources of Land Contamination)*, *Appendix A9.2 (Ladywell Landfill)* and *Appendix A9.3 (Land Contamination Risk Assessment)* and has informed the contaminated land risk assessment.

Value/Importance

9.2.18 The value/importance of receptors/attributes is assigned in Section 9.3 (Baseline Conditions) and was categorised on a scale of negligible to very high based on professional judgement in accordance with the criteria and examples outlined in Table 9.3.

Table 9.3: Value/Importance Criteria

Value/ Importance	Criteria	Examples
Very High	Attribute has a high importance and/or rarity on an international or national scale.	**Geology**
		Areas containing very rare geological features considered to be of international importance such as UNESCO World Heritage Sites, UNESCO Global Geoparks, Sites of Special Scientific Interest (SSSI) or Geological Conservation Review (GCR) sites where citations indicate features of international importance.
		Soils
		Soils directly supporting an EU designated site. Land classified as Land Capability for Agricultural (LCA) classes 1 and 2.
		Groundwater
		Groundwater aquifer(s) with very high productivity or Water Framework Directive (WFD) good groundwater quality and quantity status. Exploitation of groundwater resource is extensive for public, private domestic and/or agricultural use (i.e. feeding ten or more properties) and/or industrial supply. Groundwater aquifer supports a designated/sensitive ecosystem of international/national importance and/or supports a surface water feature with hydrological importance to a designated/protected under EC and UK legislation sensitive ecosystem. Groundwater aquifer locally supports GWDTE or wetland vegetation which is highly groundwater dependent.
		Land Contamination
		Very high sensitivity human health land use such as residential or allotments. Very high value groundwater body as defined above. Very high value surface water feature as defined in Volume 1, Part 3 - Environmental Assessment (Chapter 10: Road Drainage and the Water Environment). Internationally designated ecological sites. Scheduled Monument/Listed Building.
High	Attribute has a high importance and/or rarity on local scale	**Geology**
		Areas containing geological features considered to be rare and of national importance with little potential for replacement such as SSSI, candidate SSSI, GCR sites or geological sites which meet national designation criterion yet are not designated as such.
		Soils
		Soils directly supporting a UK designated site such as SSSI. Land classified as LCA class 3.1. NatureScot priority peatland Class 1 (nationally important carbon-rich and peaty soils, deep peat and priority peatland habitat likely to be of high conservation value) and Class 2 (nationally important carbon-rich and peaty soils, deep peat and priority peatland habitat likely to be of potentially high conservation value and restoration potential).
		Groundwater
		Groundwater aquifer with moderate/high productivity or Water Framework Directive (WFD) good groundwater quality and quantity status. Exploitation of groundwater resource is not extensive (i.e. private, domestic and/or agricultural use feeding less than ten properties). Groundwater aquifer supports a sensitive ecosystem of regional importance and/or supports a surface water feature with hydrological importance to a sensitive ecosystem of regional importance

Value/ Importance	Criteria	Examples
		Groundwater aquifer supports GWDTE or wetland vegetation which is moderately groundwater dependent.
		Land Contamination
		High sensitivity human health land use such as public open space and the proposed development construction/maintenance areas. High value groundwater body as defined above. High value surface water feature as defined in Volume 1, Part 3 - Environmental Assessment (Chapter 10: Road Drainage and the Water Environment).
Medium	Attribute has a medium quality and/or rarity on a local scale	**Geology**
		Areas containing geological features of regional importance with limited potential for replacement and considered worthy of protection for their educational, research, historic or aesthetic importance, such as Local Geodiversity Sites (LGS)/Regionally Important Geological Sites (RIGS) or geological sites which meet regional designation criterion yet are not designated as such.
		Soils
		Soils directly supporting a non-statutory designated site such as Local Nature Reserves or Sites of Nature Conservation Importance. Land classified as LCA class 3.2. NatureScot priority peatland Class 3 (dominant vegetation cover is not priority peatland habitat but is associated with wet and acidic type. Occasional peatland habitats can be found. Most soils are carbon-rich and peaty soils, with some areas of deep peat).
		Groundwater
		Groundwater aquifer with low productivity or Water Framework Directive (WFD) variable groundwater quality and quantity status. No known present exploitation of groundwater as a resource and aquifer properties make potential exploitation appear unlikely. Groundwater aquifer supports a sensitive ecosystem of authority area importance and/or a surface water feature with hydrological importance to a site of authority area importance. Groundwater aquifer locally supports GWDTE or wetland vegetation which is lowly groundwater dependent.
		Land Contamination
		Medium sensitivity human health land use such as commercial or industrial. Medium value groundwater body as defined above. Medium value surface water feature as defined in Volume 1, Part 3 - Environmental Assessment (Chapter 10: Road Drainage and the Water Environment).
Low	Attribute has a low quality and/or rarity on a local scale	**Geology**
		Sites and geological features of local importance not currently identified as SSSI, GCR or LGS/ RIGS but that may require protection in the future.
		Soils
		Land classified as LCA classes 4.1 to 7. NatureScot priority peatland Class 5 (soil information takes precedence over vegetation data and there is no peatland habitat recorded, but all soils are carbon-rich and peaty soil and deep peat).
		Groundwater
		Groundwater aquifer with very low productivity or Water Framework Directive (WFD) poor groundwater quality and quantity status.

Value/ Importance	Criteria	Examples
		No known past or present exploitation of groundwater as a resource. Groundwater aquifer supports a sensitive ecosystem of less than authority area importance and/or supports a surface water feature with hydrological importance to sensitive ecosystems of less than authority area importance. Groundwater aquifer locally supports areas of vegetation with no groundwater dependency.
		Land Contamination
		Low sensitivity human health land use such as highways and rail. Low value groundwater body as defined above. Low value surface water feature as defined in Volume 1, Part 3 - Environmental Assessment (Chapter 10: Road Drainage and the Water Environment).
Negligible		**Geology**
		Geological features not currently protected and unlikely to require protection in the future (no geological exposures or little/no local interest).
		Soils
		Previously developed land with little potential to return to agriculture. NatureScot priority peatland Class 4 (areas unlikely to be associated with peatland habitats or wet and acidic type, and unlikely to include carbon-rich or peat soils), Class 0 (mineral soils where peatland habitats are not typically found), Class -1 (unknown soil types) and Class -2 (non-soil (i.e. loch, built up area, rock and scree)).
		Land Contamination
		Undeveloped surplus land/no sensitive human health land use proposed.

Magnitude

9.2.19 The magnitude of potential impacts was assessed on a scale of major to negligible/no change for both adverse and beneficial impacts based on the likely effect of the proposed activities, based on professional judgement in accordance with the criteria and examples provided in Table 9.4. The assessment of magnitude was influenced by the timing, scale, size and duration of changes to the baseline conditions, as well as the likelihood or probability of occurrence.

Table 9.4: Magnitude criteria

Magnitude	Criteria	Examples
Major Adverse	Results in loss of attribute and/or quality and integrity of the attribute	**Geology**
		Partial (greater than 50%) or total loss of a geological feature/designation; detrimental change to quality or integrity or severe damage to key characteristics, features or elements; or where there would be complete severance of a site such as to affect the value of the site/resource.
		Soils
		Physical removal or permanent sealing of soil resource, peatland or agricultural land or where the value of the area would be severely affected. Over 2ha loss/sealing of very high/high value/importance soils or over 10ha loss/sealing of medium to low value/importance soils.
		Groundwater
		Major or long-term change to groundwater aquifer(s) flow, water level, quality or available yield.

Magnitude	Criteria	Examples
		Groundwater resource use is irreparably impacted upon, with a major or total loss of an existing supply or supplies. Changes to water table level or quality would result in a major or total change in or loss of a groundwater dependent area, where the value of a site would be severely affected. Changes to groundwater aquifer(s) flow, water level and quality would result in major changes to groundwater base flow contributions to surface water and/ or alterations in surface water quality, resulting in a major shift away from baseline conditions such as change to WFD status. Dewatering effects create significant differential settlement effects on existing infrastructure and buildings.
		Land Contamination
		Contamination levels encountered in excess of assessment criteria (for human health, environment and/or property) requiring substantial remediation works or treatment, or qualitative risk assessment identifies one or more very high/high-risk relevant pollutant linkage (as defined in *Appendix A9.3 (Land Contamination Risk Assessment)*.
Moderate Adverse	Results in effect on integrity of attribute, or loss of part of attribute	**Geology**
		Partial loss of geological feature/designation, potentially adversely affecting the integrity of the feature/designation; partial loss of and/or damage to key characteristics, features or elements such that the value of the site would be affected, but not to a major degree.
		Soils
		Permanent loss/reduction of one or more soil function(s) and restriction to current or approved future use (e.g. through degradation, compaction, erosion of soil resource). Between 1 and 2 ha loss/reduction of very high to high value/importance soils or between 1 and 10 ha loss/reduction of medium to low value/importance soils.
		Groundwater
		Moderate changes to groundwater aquifer(s) flow, water level, quality or available yield. Groundwater resource use is impacted slightly, but existing supplies remain sustainable. Changes to water table level or quality would result in partial change in or loss of a groundwater dependent area, where the value of the site would be affected, but not to a major degree. Changes to groundwater aquifer(s) flow, water level and quality would result in moderate changes to groundwater base flow contributions to surface water and/or alterations in surface water quality, resulting in a moderate shift from baseline conditions that may be long-term or temporary. Dewatering effects create moderate differential settlement effects on existing infrastructure and buildings.
		Land Contamination
		Contamination levels marginally above assessment criteria (for human health environment and/or property) requiring some treatment; or qualitative risk assessment identifies one or more moderate risk relevant pollutant linkage (as defined in *Appendix A9.3 (Land Contamination Risk Assessment)*.
Minor Adverse	Results in some measurable change in quality or vulnerability of attribute	**Geology**
		Geology: minor measurable change (up to 15%) in geological feature/designation attributes, quality or vulnerability; minor loss of, or alteration to, one (maybe more) key characteristics, features or elements.
		Soils
		Temporary loss/reduction of one or more soil function(s) and restriction to current or approved future use (for example through degradation, compaction, erosion of soil resource).

Magnitude	Criteria	Examples
		Groundwater
		Minor changes to groundwater aquifer(s) flow, water level, quality or available yield. Changes to water table level, quality and yield result in little discernible change to existing resource use. Changes to water table level or quality would result in minor change to groundwater dependent areas, but where the value of the site would not be affected. Changes to groundwater aquifer(s) flow, water level and quality would result in minor changes to groundwater base flow contributions to surface water and/or alterations in surface water quality, resulting in a minor shift from baseline conditions (equivalent to minor but measurable change within WFD status). Dewatering effects create minor differential settlement effects on existing infrastructure and buildings.
		Land Contamination
		Contamination levels marginally above assessment criteria (for human health environment and/or property) and minor remediation/mitigation works required; or qualitative risk assessment identifies one or more moderate/low to low-risk relevant pollutant linkage (as defined in *Appendix A9.3 (Land Contamination Risk Assessment)*.
Negligible	Results in effect on attribute but of insufficient magnitude to affect the use or integrity	**Geology**
		Very slight change from geological feature/designation baseline conditions where overall integrity of resource is not affected.
		Soils
		No discernible loss/reduction of soil function(s) that restrict current or approved future use. Less than 1ha loss/sealing for all grades of soil value/importance.
		Groundwater
		No measurable impact upon an aquifer and/or groundwater receptor(s). Very slight change from groundwater baseline conditions, approximating to 'no change' conditions. Dewatering effects create no or no noticeable differential settlement effects on existing infrastructure and buildings.
		Land Contamination
		Contamination levels below human health, environment and property assessment criteria and no remediation required; or qualitative risk assessment identifies no risk (as defined in *Appendix A9.3 (Land Contamination Risk Assessment)*.
Minor beneficial	Results in some beneficial effect on attribute or a reduced risk of negative effect occurring	**Geology**
		Improvement of existing geological features/designations such as cleaning existing rock exposures.
		Soils
		Return of a minor area of land (i.e. removal of hardstanding) increasing soil function(s) and increased opportunity for future beneficial use.
		Groundwater
		Reduction of groundwater hazards to existing structures.
		Land Contamination
		Change in land use so that existing risk levels are reduced.

Magnitude	Criteria	Examples
Moderate beneficial	Results in moderate improvement of the quality of the attribute	**Geology**
		Improved access to existing geological features/designations.
		Soils
		Return of a moderate area of land (i.e. removal of hardstanding) increasing soil function(s) and increased opportunity for future beneficial use.
		Groundwater
		Contribution to improvement in waterbody WFD classification. Support to significant improvements in damaged GWDTE.
		Land Contamination
		Removal of existing pollutant linkages.
Major beneficial	Results in major improvement of attribute quality	**Geology**
		Creation of new geological features/designations.
		Soils
		Return of a major area of land (i.e. removal of hardstanding) increasing soil function(s) and increased opportunity for future beneficial use.
		Groundwater
		Recharge of an aquifer. Improvement in WFD classification.
		Land Contamination
		Removal of contamination source.
No Change		No temporary or permanent loss or alteration of characteristics, features or elements; no observable impact in either direction.

Significance

9.2.20 The significance of effects was determined as a function of the value/importance of the receptor/attribute and the magnitude of the predicted impact. According to the environmental assessment methodology within DMRB LA 104, specifically for projects in Scotland, the significance of potential effect shall be reported including embedded mitigation measures. Any residual effects shall be reported after assessment of the effectiveness of potential essential mitigation measures required to reduce and, if possible, offset likely significant adverse environmental effects. The matrix for the determination of significance, provided in the DMRB LA 104 guidance, is shown in Table 9.5.

Table 9.5: Matrix for determination of significance of effect

Magnitude / Value/ Importance	No change	Negligible	Minor	Moderate	Major
Very High	Neutral	Slight	**Moderate** or **Large***	**Large** or **Very Large***	**Very Large**
High	Neutral	Slight	Slight or **Moderate***	**Moderate** or **Large***	**Large** or **Very Large***
Medium	Neutral	Neutral or Slight*	Slight	**Moderate**	**Moderate** or **Large***
Low	Neutral	Neutral or Slight*	Neutral or Slight*	Slight	Slight or **Moderate***
Negligible	Neutral	Neutral	Neutral or Slight*	Neutral or Slight*	Slight

* Where there is a choice between two significance, the highest significance has been selected by default.

9.2.21 Effects of Moderate significance and above are considered significant for this DMRB Stage 2 assessment, and the level at which mitigation would be proposed.

Limitations to Assessment

9.2.22 Information on PWS depends on the accuracy provided through consultations with landowners and the local authority. Figures 9.1 to 9.4 show indicative locations which have been based on these consultation responses and OS maps. Further detailed consultation with landowners in relation to PWS may still be required during the DMRB Stage 3 assessment. It is possible that not all PWS have been identified at this stage.

9.2.23 Baseline information on geotechnical hazards has been reviewed but potential effects associated with the proposed route options are not considered at DMRB Stage 2. This may form part of the DMRB Stage 3 assessment once further engineering detail is available.

9.2.24 Groundwater dewatering effects have the potential to generate differential ground settlement without mitigation. Potential for ground settlement is not considered at DMRB Stage 2, but this may form part of the DMRB Stage 3 assessment once further engineering detail is available.

9.2.25 An initial assessment of groundwater dewatering effects on surface water features has been undertaken based on the available GI data. This assessment will be reviewed as part of the DMRB Stage 3 assessment once further engineering detail and ground investigation data is available.

9.2.26 Information on potential sources of land contamination has been taken from historical mapping and consultation information as supplied within the Envirocheck Report (Landmark Information Group 2015), information within the three Preliminary Sources Study Reports (Scott Wilson 2011, Jacobs 2013a and Jacobs 2013b) and GI data as reported for the four phases of GI described in Table 9.2. The available data are considered sufficient for the purposes of this DMRB Stage 2 assessment.

9.2.27 Information pertinent to Ladywell Landfill has been provided by PKC. Field data, in addition to ground gas concentrations, such as groundwater levels within the borehole at the time of ground gas measurement and ground gas flow rates have not been provided. These data are important in the analysis and interpretation of ground gas flow regimes. Monitoring of the landfill does not include analysis for hydrocarbons in groundwater and some uncertainty remains over the source and potential extent of hydrocarbons detected in samples from GI in the area (refer to *Appendix A9.2: Ladywell Landfill* for more information).

9.2.28 The land contamination risk assessment undertaken within *Appendix A9.3: Land Contamination Risk Assessment* is an update of the preliminary conceptual site model presented in the three Preliminary Sources Study Reports (Scott Wilson, 2011; Jacobs, 2013a; and Jacobs, 2013b) considered suitable for a DMRB Stage 2 Options Assessment. A full update of the conceptual site model and a generic quantitative risk assessment GQRA should be undertaken as part of the DMRB Stage 3 assessment once further engineering detail and ground investigation data is available.

9.2.29 The above limitations are typical of a DMRB Stage 2 assessment, and the assessment reported in this chapter is in line with the DMRB guidance and considered robust and of an appropriate level of detail to inform the selection of the Preferred Route Option. Further detailed work would be undertaken at DMRB Stage 3 to inform the design of the Preferred Route Option.

Community Objectives

9.2.30 At an early stage in the A9 Co-Creative Process, the Birnam to Ballinluig A9 Community Group generated community objectives. The seven objectives are presented in Volume 1, Part 3 - Environmental Assessment (Chapter 7: Overview of Environmental Assessment) and cover a wide range of topics but focus predominantly on environmental issues.

9.2.31 The community objectives have been taken into consideration throughout the DMRB Stage 2 process, and a mapping exercise was conducted to indicate how, in the operational phase, the proposed route options could contribute to the relevant community objectives. Details of how each environmental topic contributes towards achieving the community objectives are presented in *Appendix A7.1: Mapping of Community Objectives Against DMRB Stage 2 Route Options* and a summary for this chapter is presented in Section 9.6 (Summary of Route Options Assessment).

9.3 Baseline Conditions

Soils

9.3.1 The majority of the study area is underlain by humus-iron podzols which may also contain some alluvial soils associated with the valley floors, terraces and mounds (UK Soil Observatory, 2021). In the east of the study area, near the Pass of Birnam, parts of the existing A9 and the proposed route options are underlain by alluvial soils of the River Tay floodplain. There are also brown forest soils within the study area which are present on the hills and valley sides along with some humus-iron podzols and humic gleys.

Agricultural Soils

9.3.2 The Land Capability for Agriculture (LCA) classification system was devised to rank land on the basis of the land's potential productivity and cropping flexibility (James Hutton Institute, 2016). The determination of the land's potential productivity and cropping flexibility is based on the extent to which the physical characteristics of the land (soil, climate and relief) impose long term restrictions on its use and capability to grow certain types of crops and grass. Land is classified into seven main classes, some of which have subdivisions, with Class 1 being the best quality agricultural land and Class 7 the poorest with limited agricultural potential. Classes 1, 2 and 3.1 are known as prime agricultural land and Classes 3.2 to 7 are known as non-prime land.

9.3.3 There are four areas of prime agricultural land within the study area, all of which are classified as LCA Class 3.1 as shown on Figures 9.1 to 9.4. One area to the south of Birnam (north of Dalpowie Plantation) on both banks of the River Tay, a second area to the northeast of Dunkeld, a third area in proximity to the River Tay Crossing on the western bank of the River Tay and a fourth area at the northernmost extent of the study area on the eastern bank of the River Tay. Based on the criteria within Table 9.3 agricultural soils of LCA class 3.1 are recognised as being of high value/importance.

9.3.4 LCA Class 3.2 (land capable of average production although high yields of barley, oats and grass are possible) is present from the southernmost extent of the study area to the junction between the A9 and B867, to the west of Dunkeld at Bishop's Hill, to the northwest of Inver at the Hermitage and south of the existing Dalguise Junction at the foot of Inver Wood. Based on the criteria within Table 9.3 agricultural soils within this classification are considered to be of medium value/importance.

9.3.5 The remainder of the study area comprises either LCA Classes between Class 4.1 and Class 7 or is noted to be land not capable of supporting agriculture and not assigned a classification (urban areas such as Birnam, Little Dunkeld, Dunkeld and Inver). Based on the criteria within Table 9.3 agricultural land within LCA Classes 4.1 and 7 is considered to be of low value/importance. Urban soils are not considered as part of this assessment.

9.3.6 Further information on the economic/operational value of agricultural land is provided in Volume 1, Part 3 – Environmental Assessment (Chapter 8: Population – Land Use).

Peat Soils

9.3.7 No peat deposits are recorded on BGS Onshore Geoindex (BGS 2021) within the study area. In addition, the entire study area is classified as Class 0 (mineral soils where peatland habitats are not typically found) by the NatureScot Carbon and Peatland Map (2016) with a small area at Birnam, Little Dunkeld and Dunkeld classified as Class -2 (non-soil; i.e. loch, built up area, rock and scree).

9.3.8 A review of GI data indicated that peat was encountered in three boreholes and two trial pits:

- Within Dalpowie Plantation (ch1190) the driller recorded peat 0.1 m thick at ground level within one borehole. There was no geological engineering log available to verify this interpretation.
- Three locations encountered peat in the vicinity of Ring Wood (ch2000). A borehole recorded a firm greyish brown to dark brown, slightly gravelly pseudo fibrous peat 0.9 m thick at a depth of 1.9 m below ground level (bgl). One trial pit recorded peat in two buried horizons; one horizon as occasional pockets of firm amorphous peat from 3 m bgl to 3.4 m bgl, the other as firm dark brown plastic amorphous to pseudo fibrous peat encountered at 3.4 m bgl to the excavation extent at 3.9 m bgl. A second trial pit recorded thick laminations of sandy peat within made ground from 0.8 m bgl to 2.8 m bgl.
- At an A9 embankment near Birnam (ch2940), a dark brown to grey, clayey, pseudo fibrous peat 0.5 m thick was encountered at a depth of 6 m bgl in-between two silt horizons which both contained peat inclusions. The upper silt (3.9 to 6 m bgl) had a thin brown pseudo fibrous peat lamination at 5.5 m bgl, while the lower silt (6.5 to 7.6 m bgl) contained occasional pockets of brown pseudo fibrous peat.

9.3.9 Peaty soils were identified in a further six borehole locations, predominantly within the Dalpowie Plantation and Ring Wood areas south of Birnam. The peaty soils were generally encountered in the top 0.1 m.

9.3.10 Based on the criteria presented in Table 9.3, peaty soils and peat deposits present in the study area are considered to be of negligible value/importance. As stated in paragraph 9.2.2, the assessment of peat, when considered as a material asset, is undertaken in Volume 1, Part 3 - Environmental Assessment (Chapter 18: Material Assets and Waste).

Geology

Designated Geological Receptors

9.3.11 There are no designated geological receptors or Geological Conservation Review (GCR) sites present within the study area. The River Tay is designated as a Special Area of Conservation (SAC) throughout

the study area, however, it is designated for its clear-water lakes, Atlantic salmon, lamprey (river, brook and sea) and otter and not for its geological features. Further details are described in Volume 1, Part 3 - Environmental Assessment (Chapter 11: Biodiversity).

Made Ground

9.3.12 No made ground is recorded on the BGS Onshore Geoindex (BGS, 2021) within 250 m of the proposed route options. However, it is likely that made ground is present in the vicinity of the existing A9 and the Highland Main Line railway as both were constructed upon embankment in several sections which are likely to comprise significant deposits of made ground.

9.3.13 GI encountered made ground in 124 of 328 boreholes up to a maximum depth of 12.8 m bgl and within 37 trial pits to a maximum depth of 3.4 m bgl. The made ground, where present, generally comprised fine to coarse sand and gravel of mixed igneous and metamorphic lithologies, commonly with tarmacadam and concrete and less commonly with ash, brick, glass and clinker. The majority of the made ground encountered was associated with the existing A9 and Highland Main Line railway. The less common brick, ash and clinker inclusions were generally located within embankments close to the small communities along the A9 route corridor.

9.3.14 Based on the criteria presented in Table 9.3, made ground present in the study area is considered to be of negligible value/importance.

Superficial Geology

9.3.15 Superficial deposits are recorded as alluvium, minor alluvial fan deposits, river terrace deposits, glaciofluvial deposits and Devensian glacial till (BGS 2021).

9.3.16 The majority of the existing A9 is underlain by glaciofluvial deposits comprising sand and gravel with local lenses of silt, clay and organic matter. Where the existing A9 is located close to the River Tay, for example at Inver, the River Tay Crossing and west of Little Dunkeld, the underlying superficial material comprises river alluvium, a silty clay which can contain layers of silt, sand, gravel and peat.

9.3.17 River terrace deposits are recorded in the west of the study area, further up slope on the edge of the floodplain, and are generally described as being comprised of sand and gravel with local lenses of silt, clay or peat.

9.3.18 Glacial till is generally recorded on the higher ground of the valley sides and is typically composed of a wide range of poorly sorted clays, sands and gravels.

9.3.19 GI encountered a highly variable sequence of glacial, river terrace and alluvial deposits which predominantly comprised medium dense to very dense, locally silty or clayey sands and gravels with variable cobble and boulder content. The total thickness of superficial materials ranged from locally absent in an area west of Inver (around ch5580) to 79.5 m bgl to the north of the River Tay Crossing (ch7690). From the boreholes reviewed within the proposed cutting areas, the proven total thickness of superficial deposits was generally greater than 15 m thick, with the exception of the area west of Inver.

9.3.20 Based on the criteria presented in Table 9.3, superficial deposits present in the study area are considered to be of negligible value/importance.

Bedrock Geology

9.3.21 The bedrock geology underlying the majority of the study area is low grade metamorphic bedrock of Dalradian age, belonging to the Southern Highland Group. Generally, the Southern Highland Group is

comprised of interbedded pelites, semipelites, psammities and metasandstones. The BGS Onshore Geoindex (BGS, 2021) indicates a specific area of micaceous psammite at the River Tay Crossing.

9.3.22 Sedimentary bedrock of Devonian age belonging to the Craighall Conglomerate Formation of the Arbuthnott-Garvock Group underlies the southern section of the study area at the Pass of Birnam. The Craighall Conglomerate Formation is generally a massive, well rounded, pebble and boulder conglomerate of andesitic lava interbedded with basaltic lava members and minor sandstone, siltstone and mudstone beds.

9.3.23 A single Tholeitic Lava Dyke from the Carboniferous Period is mapped crossing the proposed route south of Little Dunkeld.

9.3.24 The Highland Boundary Fault Zone forms the boundary between the Dalradian metamorphic bedrock and the Devonian sedimentary bedrock. The zone comprises a series of faults which cross the proposed route options in the vicinity of Pass of Birnam trending south-west to north-east.

9.3.25 The GI data confirmed the BGS published data with igneous and conglomerate bedrock encountered at the Pass of Birnam and Birnam Wood, and metamorphic and meta-sedimentary bedrock encountered across the remainder of the study area. The depth to bedrock varied across the study area between surface outcrop to the west of Inver to over 55 m bgl in depth at the River Tay Crossing. The maximum depth of bedrock encountered was 79.5 m bgl (north of the River Tay Crossing). The majority of borehole locations did not encounter bedrock and overall rockhead is generally greater than 15 m bgl across much of the study area with the exception of the following areas:

- north of the existing A9, at approximately ch100 to ch350, rockhead was recorded between 7 m bgl and 10 m bgl;
- east of the existing A9 at approximately ch2250 to ch2300, rockhead was recorded between 0.1 m bgl and 10 m bgl;
- in the vicinity of Inchewan Burn to the south of existing A9 at approximately ch3450, rockhead was recorded between 2.35 m bgl and 10 m bgl;
- south-west of the Highland Main Line railway at approximately ch3500 to ch3700 (vicinity of Ladywell Landfill) rockhead was recorded between 3 m bgl and 7 m bgl;
- west of Inver in the vicinity of the existing A9 (approximately ch5600) rockhead was recorded between surface outcrop and 7.5 m bgl;
- to the west and immediately below the existing A9 (approximately ch6250 to ch6330) rockhead was recorded between 0.3 m bgl and 3 m bgl; and
- to the east of the existing A9 from approximately ch7900 to the end of the study area, rockhead was recorded between 2.4 m bgl and 10.2 m bgl.

9.3.26 Based on the criteria presented in Table 9.3. bedrock in the study area is considered to be of negligible value/importance.

Mineral Extraction

9.3.27 There are no records of historic or current coal mining activity within the study area. A Mineral Valuer's Report included within a preliminary sources study report (PSSR) undertaken by Scott Wilson in 2011 (Scott Wilson, 2011) states that historical mining for lead, copper and zinc (potential mineral veins within the Dalradian bedrock) may have taken place within the study area beneath a 1 km section proximal to the existing A9 west of Little Dunkeld (approximately equivalent to ch5100 to ch6100 of the currently proposed route options). The mineral valuer's report also provided co-ordinates for two known mine entries (301200,724600 and 301300,742600), located in the study area on the opposite bank of the River Tay. Although no historical or current workings are recorded in the vicinity of the proposed route

options, it is possible that unrecorded workings exist at shallow depth (less than 30 m depth). The mineral valuer's report stated that on the basis of available information future underground mining workings were considered unlikely to occur.

9.3.28 Review of historical OS maps supplied within the Envirocheck report (Landmark Information Group, 2015) recorded four old or disused quarries (PBTC-C7, PBTC-C9, PBTC-C10 and PBTC-C22) and two gravel pits (PBTC-C4 and PBTC-C15) in the study area. Additional information from the Envirocheck report states that PBTC-C7 (Birnam Lower Level) and PBTC-C9 (Birnam) were opencast slate mines which have now ceased to operate. The Envirocheck report also states that PBTC-C22 (Ladywell Landfill) was an opencast igneous and metamorphic (bedrock) mine which has now also ceased to operate. Further details are provided in *Appendix A9.1: Potential Sources of Land Contamination within Study Area* with locations shown on Figures 9.1 to 9.4.

9.3.29 Based on this historical evidence of gravel and bedrock extraction and recorded superficial geology, there is potential for further mineral resources to be available within the study area. As stated in paragraph 9.2.2, mineral resources are assessed in Volume 1, Part 3 - Environmental Assessment (Chapter 18: Material Assets and Waste).

Geotechnical Hazards

9.3.30 The geotechnical PSSR undertaken in 2011 by Scott Wilson provided details on a historical landslide event to the north of the River Tay Crossing at the foot of Craig a Barns (Scott Wilson, 2011).

9.3.31 The 2011 PSSR reported that after a period of prolonged rainfall, a historical landslide (later classified as a debris flow) occurred in August 2004 at the foot of Craig a Barns. The primary cause of the landslide was the volume of surface water originating from the woodland topographically above, which overwhelmed the former A9 drainage system (the former A9 is now an unclassified road located approximately 130 m east of the existing A9). By entering the former A9 drainage system the surface water flows were concentrated onto the slopes below in three areas causing further erosion and flooding of the existing A9. Three distinct scars within the existing A9 cut slopes, estimated at up to 4 m deep and 6 m wide, had to be filled and covered with armour stone. No remedial measures for the remaining slope areas were documented and therefore it is conceivable that during rainfall events further slope instabilities could occur in this area.

9.3.32 Further information on geotechnical hazards is provided within Volume 1, Part 2 - Engineering Assessment, Section 5.9 (Geotechnics and Earthworks).

Groundwater

9.3.33 The superficial deposits within the study area have been identified and discussed within the previous section. Table 9.6 provides the hydrogeological characteristics of the geological units identified within the study area and discusses the potential for groundwater connectivity between these units using information adapted from the BGS Hydrogeological Map of Scotland (1988a).

Table 9.6: Hydrogeological Characteristics of Superficial and Bedrock Geological Units

Geological Unit		Geological Characteristic	Hydrogeological Characteristic
Superficial	Peat/peaty soils	Partially decomposed organic matter	Very poor groundwater potential and limited spatial extent. No, or very little, connectivity with higher permeability deposits.
	Made Ground	Variable composition	Highly variable groundwater potential due to surface/close surface location and variable permeability.
	Alluvium	Unconsolidated clay, silt, sand and gravel	Local groundwater potential, the groundwater system is expected to be unconfined and hydraulically connected to surface water and other high permeability superficial deposits.
	Glaciofluvial Deposits	Sand and gravel, locally with lenses of silt, clay and organic material.	Locally important aquifer with groundwater potential, the groundwater system is expected to be hydraulically connected to surface water and other high permeability superficial deposits.
	River Terrace Deposits	Sand and gravel, locally with lenses of silt, clay or peat.	Local groundwater potential, the groundwater system is expected to be hydraulically connected to surface water and other high permeability superficial deposits.
	Alluvial Fan Deposits	Composed of variable sediments including clay, silt, sand, gravel and peat	Local groundwater potential, the groundwater system is expected to be hydraulically connected to surface water and other high permeability superficial deposits.
	Glacial Till	Comprised of boulders, sands and gravels in a clay matrix	Poor groundwater potential due to generally low and variable permeability. No, or very little, connectivity with higher permeability deposits.
Bedrock	Southern Highland Group	Interbedded pelites, semipelites, psammities and metasandstones.	This unit has typically poor groundwater potential except through fracture networks. Some connectivity with high/moderate permeable deposits/strata where direct contact with fractures and weathered surfaces exists.
	Arbuthnott-Garvock Group	Massive well rounded, pebble and boulder conglomerate strata of andesitic lava interbedded with basaltic lava members and minor sandstone, siltstone and mudstone beds.	Locally yields moderate amounts of groundwater. Likely connected with high/moderate permeable deposits/strata where direct contact exists.
	Tholeiitic Lava Dyke	Intrusive igneous rocks.	Very poor groundwater potential. No, or very little, connectivity with higher permeability deposits and limit.

9.3.34 Groundwater within superficial deposits underlying the site is predominantly present within glaciofluvial deposits, river terrace deposits and alluvial fan deposits and there is likely a high degree of connectivity between these deposits where contact exists. SEPA has identified these superficial deposits into two separate water bodies; the Isla and Lower Tay Sand and Gravel aquifer, located east of Little Dunkeld and the Tummel and Tay Sand and Gravel aquifer, located to the west. Although not typically associated as a groundwater unit within the two identified superficial water bodies, groundwater within peat/peaty soils and made ground deposits could in fact form part of, or influence, the two superficial water bodies on a local scale.

9.3.35 SEPA have also identified two bedrock aquifers in the study area; the Bankfoot aquifer and the Killin, Aberfeldy and Angus Glens aquifer, both correlating to the underlying published geological units; the Arbuthnott-Garvock Group and the Southern Highland Group respectively. There is potential for connectivity between the superficial and bedrock aquifers, however, the presence of glacial till deposits

and other cohesive layers, such as silt and clay, within the superficial deposits may act as a barrier or aquitard between the bedrock and superficial aquifers where they are present.

9.3.36 Table 9.7 provides further detail on the characteristics of each identified water body summarising information from the interactive SEPA Water Environment Hub (SEPA, 2021a), interactive SEPA Water Classification Hub (SEPA, 2021b) and BGS Hydrogeological Map of Scotland (BGS, 1988a) and assigns a value/importance based on the criteria presented in Table 9.3.

Table 9.7: Groundwater Water Body Characteristics

Groundwater Aquifer (SEPA identification)	Characteristics	Corresponding Geological Unit(s)	Value/ Importance
Isla and Lower Tay Sand and Gravel aquifer (150740)	A locally important aquifer, groundwater potential varies depending upon the thickness of the saturated material giving borehole yields up to 10-15 l/s. Classified as good with medium confidence for both quality and quantity by SEPA in 2018. Was previously classified as poor with medium confidence between 2012 and 2017, with an upward trend in pollutants attributed to arable farming abstractions and diffuse pollution.	Peat/peaty soils, Made Ground, Alluvium, Glaciofluvial Deposits, Alluvial Fan Deposits, Glacial Till	High
Tummel and Tay Sand and Gravel aquifer (150735)	A concealed aquifer which has limited or local potential, borehole yields are typically small (between 1-2 l/s). Classified as good with medium confidence for both quality and quantity between 2012 and 2018 by SEPA.	Made Ground, Alluvium, River Terrace Deposits, Glaciofluvial Deposits	High
Bankfoot aquifer (150657)	A locally important aquifer with reported yields varying between 1 l/s and 10-12 l/s. Classified as good with medium confidence for both quality and quantity in 2018. Previously, arable farming abstractions were recognised as a pressure on the aquifer, resulting in a poor with medium confidence classification for groundwater quantity between 2012 and 2017 by SEPA.	Craighall Conglomerate Formation (Arbuthnott-Garvock Group)	High
Killin, Aberfeldy and Angus Glens aquifer (150699)	Low productivity aquifer with typically poor groundwater potential except through fracture networks associated with tectonism or near surface weathering. Classified as good with medium confidence for both quality and quantity between 2012 and 2018 by SEPA.	Southern Highland Group, Tholeiitic Lava Swarm	Low

Groundwater Monitoring

9.3.37 Groundwater level data were available for 87 boreholes installed along the length of the existing A9 within the study area. A monitoring period of 14 months was available for the majority of locations (SEGL, 2015). A limited monitoring period consisting of two months was available for the Advanced GI (10 locations) (Fugro, 2016a and b) while the monitoring periods for the Preliminary (three locations) (Fugro, 2017) and Detailed GI (nine locations) (Fugro, 2018) consisted of seven and nine months respectively. Seven of the installed boreholes were screened across both superficial and bedrock units generally located where the superficial material was under 15 m bgl. The remaining 80 borehole installations were screened entirely within superficial deposits reaching depths between 7 m bgl and 50 m bgl.

9.3.38 Twenty locations were noted to be dry during their respective monitoring periods with a further seven locations recording groundwater levels close to the installation depth limit making these locations an unreliable indicator. The remaining 60 locations recorded maximum groundwater levels generally at

depths in excess of 10 m bgl. However, there was a large variation seen throughout the study area with maximum recorded groundwater levels ranging from surface level to over 20 m bgl. Six locations recorded maximum groundwater levels in excess of 20 m bgl, the deepest at 26 m bgl in proximity to the existing A9 at Little Dunkeld (ch3900).

9.3.39 Shallow groundwater levels were typically encountered close to surface water features (the River Tay and River Braan) and in areas where especially thin superficial deposits lie upon the low permeability metamorphic bedrock. Four locations recorded maximum groundwater levels within the top 1 m, three of which were in proximity to surface water features or shallow soils.

9.3.40 Based on these groundwater monitoring results and the local geology (highly permeable sands and gravels overlying impermeable bedrock) groundwater flow is expected to be predominantly within the immediate overlying superficial deposits (typically sands and gravels) and the uppermost weathered section of bedrock (if present). Where bedrock is shallow there may be isolated areas of perched groundwater in the overlying superficial deposits. The consequence of this is that the depth to groundwater and groundwater flow is highly variable across the study area and can be dependent upon the depth to bedrock. Groundwater flow direction within the superficial deposits is likely to be controlled by local topography and directed towards the surface watercourses. The direction of bedrock groundwater flow is unknown.

Groundwater Quality

9.3.41 The Envirocheck report (Landmark Information Group, 2015) indicates that there are six discharge consents within the study area. One is associated with Dunkeld Waste Water Treatment Works (PBTC-C12). The remaining five are all linked to discharge of treated water from private septic tanks, primarily clustered around Inver (PBTC-C42 to PBTC-C46). Eleven septic tanks have been recorded as part of the landowner consultation responses (PBTC-C32 to PBTC-C41 and PBTC-C48). The locations of these are shown in Figures 9.1 to 9.4.

9.3.42 The Baseline Scotland: The Lower Devonian aquifer of Strathmore (BGS, 2006) report, which encapsulates the Bankfoot aquifer, describes the groundwater in the aquifer as generally weakly mineralised, with near neutral to alkaline pH values and high nitrate and elevated phosphate concentrations recorded across aquifer units. The study area lies within a groundwater Drinking Water Protected Area as all groundwater bodies in Scotland have a protected designation. The southern extent of the study area, where the Isla and Lower Tay Sand and Gravel aquifer and Bankfoot aquifer are present, is classed as a Nitrate Vulnerable Zone (NVZ) by the Scottish Government (Scottish Government, 2015) under the European Commission's Nitrates Directive 91/676/EEC.

9.3.43 The BGS Groundwater Vulnerability Map (BGS, 1988b) indicates that the superficial deposits within the study area are moderately permeable, with intermediate leaching potential (i.e. moderate ability to attenuate diffuse pollution). In addition, the Baseline Scotland: the Lower Devonian aquifer of Strathmore (BGS, 2006) report confirms that groundwater in the Bankfoot aquifer is highly vulnerable to contamination from surface activities. Low permeability ground cover such as hardstanding (existing road infrastructure and Highland Main Line Railway embankments) over the areas of made ground will prevent or reduce the amount of surface water (and potential diffuse pollution) infiltration.

9.3.44 The groundwater sample chemical analysis results from A9 Dualling GI data have been compared against Resource Protection Values (RPV) as defined within SEPA Position Statement WAT-PS-10-01 (SEPA, 2014a). SEPA have not assigned an RPV for petroleum hydrocarbons, therefore, the laboratory limit of detection (LOD) has been adopted as a conservative GAC. This screening exercise has identified predominantly marginal and isolated exceedances for ammoniacal nitrogen, nitrate, arsenic, chloride, chromium, total cyanide and iron across the study area. Marginal and isolated exceedances of cadmium and mercury with respect to the minimum reporting value have also been observed across the study area, the concentrations, however, are well below the RPV indicative of significant pollution. Incidents of

elevated concentrations of polycyclic aromatic hydrocarbons (PAHs), petroleum hydrocarbons and manganese were more common across the study area.

9.3.45 The PAHs and petroleum hydrocarbon concentrations predominantly coincided with two identified potential contaminated land sources, the existing A9 (PBTC-C1) and/or the Highland Main Line railway (PBTC-C2) embankment soils where olfactory evidence and/or chemical data suggested the presence of hydrocarbons. Three locations with marginal PAHs and petroleum hydrocarbon exceedances were within or in close proximity to Ladywell Landfill site, but groundwater monitoring at the landfill site does not include analysis for hydrocarbons and a connection cannot currently be confirmed. Appendices *Appendix A9.1: Potential Sources of Land Contamination Within Study Area* and *Appendix A9.2: Ladywell Landfill* consider the chemical analysis of groundwater samples in greater detail including additional groundwater quality data information from PKC.

Abstractions

9.3.46 Table 9.8 summarises groundwater abstraction features identified within the study area. It should be noted that some of the PWS identified using OS map information have been found to be abandoned/inactive following landowner consultation and these have been removed from the assessment. All active PWS networks identified are of high value/importance.

Table 9.8: Summary of Identified Abstractions, Springs and Private Water Supplies

PWS Reference	Feature Type	Distance from Existing A9	Comments
PBTC-S1	Spring noted on OS map and landowner consultation.	150m south (ch1300)	Abandoned/not active
PBTC-S2	Spring noted on OS map and landowner consultation.	590m south (ch3100)	Abandoned/not active
PBTC-S3	Spring noted on OS map and landowner consultation.	130m north (ch3450)	Abandoned/not active
PBTC-W1	Well noted on OS map and landowner consultation.	330m east (ch7800)	Abandoned/not active
PBTC-PWS1	Identified during landowner consultation.	390m south-east (ch0)	Active spring feeds domestic/commercial water supply for Murthly Castle and associated rental properties. Also used to supply drinking water for cattle. 150 years old.
PBTC-PWS2	Identified during landowner consultation.	600m north-east (ch0)	Active borehole supply for one residential property, Boat of Murthly (60ft deep). Eight-year-old domestic/drinking water supply. No water mains supply to property.
TB-PWS1	Identified during landowner consultation.	150m north-east (ch8400)	Active borehole supply for one residential property: Woodlands Cottage. Fourteen-year-old domestic/drinking water supply. No water mains supply to property.

Ecological Receptors with Potential Groundwater Component

9.3.47 Preliminary assessment of ecological receptors based upon the Phase 1 habitat survey provided by AECOM (Transport Scotland, 2011) identified eight habitats which had the potential to be, at least partially, supported by groundwater inflows. However, following further surveys undertaken by Jacobs in October 2015, it was considered that none of these habitats were GWDTEs as defined in Land Use Planning System Guidance Note 31 (SEPA, 2014b).

9.3.48 Other ecological receptors are identified and described further in Volume 1, Part 3 - Environmental Assessment (Chapter 11: Biodiversity).

Surface Water Features

9.3.49 Surface water features are expected to have a groundwater baseflow component, and groundwater may be a contributor to river flooding mechanisms.

9.3.50 The main watercourse within the study area is the River Tay, which is predominantly situated to the north and east of the existing A9 as far as the crossing of the River Tay at the northern end of the study area, where it is then located to the west (ch7500). Throughout the study area the River Tay is designated as a Special Area of Conservation (SAC) and is designated for its clear-water lakes, Atlantic salmon, lamprey (river, brook and sea) and otter. Further information on protected species and habitats is provided in Volume 1, Part 3 - Environmental Assessment (Chapter 11: Biodiversity).

9.3.51 The stretch of the River Braan, a tributary of the River Tay, within the study area also forms part of the River Tay SAC designation. The River Braan flows in close proximity to the existing A9 near Inver, subsequently crossing beneath the existing A9 between Inver and Little Dunkeld (ch3400).

9.3.52 Watercourses within the study area are identified and described further in Volume 1, Part 3 - Environmental Assessment (Chapter 10: Road Drainage and the Water Environment).

9.3.53 The value/importance of each surface water feature for the purposes of assessing potential impacts relating to groundwater dewatering effects follows the criteria in Table 9.3 and reflects the hydrological importance of that surface water feature in supporting sensitive ecosystems. As such, both the River Tay and the River Braan are considered to be of very high value/importance. The value/importance of surface water features with respect to potential dewatering effects are provided within *Appendix A9.4: (Surface Water Indirect Dewatering Assessment)*.

Land Contamination

9.3.54 The assessment of land contamination has focused on the potential for impacts and effects on receptors as a direct consequence of encountering contamination along the four proposed route options associated with identified on-site (within the proposed route option footprint) and off-site (outside the proposed route option footprint) potential sources of land contamination. Details of the identified potential sources of land contamination and potential human health and water environment receptors within the study area are provided below. An evaluation of risk is central to the assessment and management of contaminated land as defined by Part IIA of the Environmental Protection Act 1990 and is implemented through the Contaminated Land (Scotland) Regulations 2000 (as amended). The main principle of this approach is that a risk only exists if a suitable pathway exposes identified receptors to the hazard (or source) in question. This is referred to as a pollutant linkage. To support the DMRB Stage 2 assessment, a separate land contamination risk assessment has been undertaken and is presented in *Appendix A9.3: Land Contamination Risk Assessment*.

Potential Sources of Land Contamination

9.3.55 The desk study review identified 50 potential sources of land contamination within the study area. The potential sources of land contamination include former small-scale industries such as blacksmiths, sawmills, corn mills, gas works, storage tanks and historical gravel pits/quarries in addition to a landfill, road and rail embankments, a waste water treatment works, infilled curling ponds, an infilled pond, a depot, garages and fuel stations. Sixteen of the 50 identified potential sources of land contamination pertain to residential septic tanks or septic tank discharge points. Further details of the identified potential sources of land contamination, inclusive of a summary of relevant GI observations and geo-chemical analysis derived from the scheme specific GIs, are provided in *Appendix A9.1: Potential Sources of Land Contamination within Study Area* with their locations shown on Figures 9.1 to 9.4.

9.3.56 The landfill identified as one of the 50 potential sources of land contamination refers to Ladywell Landfill (PBTC-C22) which is operated by PKC under Waste Management Licence (WML) WML/E/20050. *Appendix A9.2: Ladywell Landfill* provides a review of the available information pertinent to Ladywell Landfill as provided by PKC and GI data. *Appendix A9.2: Ladywell Landfill* also includes an assessment of the potential land contamination risks associated with Ladywell Landfill and identification of any data and/or information gaps.

Potential Receptors

9.3.57 Potential receptors within the study area with respect to potential land contamination comprise human health and water environment receptors as shown in Table 9.9. The different human health receptor groups have been assigned a value as defined within DMRB LA 109 which is reflective of the nature of typical land use. For example, long-term exposure and an increased number of plausible pollutant pathways are associated with residential land use and therefore categorised as a very high sensitivity human health land use. In contrast land used as highways or rail land is categorised as low sensitivity human health land use due to the transient exposure and a reduced number of plausible pollutant pathways. The value assigned for water environment receptors have been assigned based on the definitions within DMRB LA 113. Professional judgement has been adopted to assign a value where the receptor value is not assigned by DMRB LA 109 or DMRB LA 113 definitions.

Table 9.9 Assigned Value for Potential Receptors within Study Area

Receptor Name	Value	Description
Human Health		
Construction Workers	High	Associated with the construction of the proposed route options.
Maintenance Workers	High	Associated with the operation of the proposed route options.
Adjacent Residents/Workers	Very High	Residential areas throughout the study area including Birnam, Dunkeld and Inver.
	High	Areas of public open space throughout the study area.
	Medium	Commercial/industrial areas throughout the study area.
Road/Rail Users	Low	Existing road and railway infrastructure throughout the study area.
Water Environment		
Surface Water	Very High to Low	All surface water features within study area including River Tay, Inchewan Burn and River Braan.
Superficial groundwater	Medium	Isla and Lower Tay Sand and Gravel aquifer.
	Medium	Tummel and Tay Sand and Gravel aquifer.
Bedrock groundwater	Medium	Bankfoot aquifer.
	Low	Killin, Aberfeldy and Angus Glens aquifer.

9.4 Potential Impacts and Effects

Introduction

9.4.1 To aid comparative assessment, the following section presents impacts and effects considered to be common to all proposed route options, followed by those that are specific to each of the proposed route options. The potential impacts and effects are assessed prior to the implementation of potential mitigation which would be developed in detail as part of the DMRB Stage 3 design and assessment. However, it should be noted that some aspects that influence geology, soils and groundwater such as cuttings have been considered as early 'embedded' mitigation through the DMRB Stage 2 design process and as such are incorporated within each of the proposed route option designs as presented and assessed in this DMRB Stage 2 assessment report. Potential mitigation is identified and described in Section 9.5 (Potential Mitigation).

9.4.2 Construction and operational phases have been considered together as the majority of construction effects (such as land-take, removal of excavated material or dewatering due to road cuttings) would extend throughout the operational phase. Where differences in impacts are predicted between the construction and operational phases, these impacts have been assessed for each phase in turn.

9.4.3 There are a variety of ways in which road development schemes can impact on geological resources, which include:

- Loss of agricultural or carbon rich soils;
- excavating or masking exposures of bedrock or superficial geological deposits of specific scientific interest if the features of interest are not reproduced elsewhere in the area;
- constraint or limitation to existing or potential commercial exploitation of resources;
- impacts on underlying groundwater aquifers, for example, through the dewatering of aquifers as a result of construction works involving excavation;
- risk of spillage or leakage of fuel or oil from storage tanks or construction plant, which without suitable mitigation measures, can enter aquifers;
- impacts as a consequence of changes to groundwater flow or quality on secondary receptors such as groundwater abstractions, surface water or GWDTEs; and
- surface runoff from the operational carriageway may contain elevated concentrations of pollutants such as oils, suspended solids, metals (e.g. copper and zinc) and, in winter, salt and antifreeze agents (e.g. ethylene glycol), leading to pollution of the aquifers.

Impacts and Effects Common to All Route Options

9.4.4 A key aspect of the impact assessment is to identify areas of proposed excavations. Information on the proposed excavation areas (referred to as cuttings) that are common to all proposed route options is provided in Table 9.10, with locations shown on Figures 9.1 to 9.4. It should be noted that only cuttings deeper than 1 m are included as shallower cuts have limited potential to intercept the water table or cause significant dewatering effects. Three cuttings are considered likely to encounter bedrock and three cuttings are considered likely to encounter groundwater.

Table 9.10: Cutting Depths Common to All Route Options

Cutting ID	Approximate Chainage	Approximate Maximum Excavation Depth (m bgl)	Local Minimum Recorded Depth to Bedrock (m bgl)	Local Maximum Recorded Groundwater Level (m bgl)	Likelihood of Intercepting Bedrock	Likelihood of Intercepting Groundwater
C3	5000 to 5200	5.8	Deeper than 22.0	Deeper than 20.0	Unlikely	Unlikely
C4	6150 to 6450	11.8	0.3	2.0	Likely	Likely
C5	7900 to 8421	4.8	3.2	5.0	Likely	Unlikely
CS7	6650 to 7150	24.6	27.8	5.0	Unlikely	Likely
CS8	7150 to 7450	8.7	14.6	11.0	Unlikely	Unlikely
Pond G (ST2A)/ Pond H (ST2B)/ Pond F (ST2C and ST2D)	20 to 130*	1.5	Deeper than 20.0	2.4	Unlikely	Unlikely
Pond H (ST2A)/ Pond I (ST2B)/ Pond G (ST2C and ST2D)	20 to 150*	1.1	12.8	7.6	Unlikely	Unlikely
Pond I (ST2A)/ Pond J (ST2B)/ Pond H (ST2C and ST2D)	10 to 80*	3.3	Deeper than 15.0	5.0	Unlikely	Unlikely
Pond J (ST2A)/ Pond K (ST2B)/ Pond I (ST2C and ST2D)	10 to 100*	12.7	6.0	5.0	Likely	Likely

*Side Road/Pond chainage, not mainline chainage.

Soils

Agricultural Soils

9.4.5 The estimate of land-take from Agricultural Holdings by LCA Class reported within Volume 1, Part 3 - Environmental Assessment (Chapter 8: Population - Land Use) has been used to identify the potential for the physical removal or permanent sealing of agricultural soils. The estimated land-take is based on the footprint of the proposed route options. Potential impacts and effects on agricultural soils are reported for each proposed route option and as such significance of effects is not reported in this section.

Peat Soils

9.4.6 Peaty soils and buried peat horizons (negligible value/importance) within or in proximity to Dalpowie Plantation and Ring Wood may be indicative of localised peat deposits (low value/importance) within these areas which could be potentially impacted by the construction of the proposed route options. Removal of peat is expected to be limited and would represent an impact magnitude of minor adverse, resulting in a potential effect of Slight significance during both construction and operation phases of all proposed route options.

Geology

Superficial Geology

9.4.7 Superficial deposits (negligible value/importance) within the study area are likely to be affected by the formation of cuttings and other earthworks during construction of the proposed route options. The reduction in the extent of these superficial deposits as a result of these construction activities is considered to be of minor adverse magnitude for all superficial deposits as well as soils and made ground because of the widespread presence of these deposits elsewhere in the region and country. This results in a potential effect of Slight significance for all superficial deposits during both construction and operation phases of all proposed route options.

Bedrock Geology

9.4.8 Table 9.10 indicates that bedrock (negligible value/importance) is likely to be intercepted by three of the proposed cuttings common to all proposed route options. This is expected to represent a minor adverse potential magnitude of impact because of the widespread presence of these deposits, resulting in an overall potential effect of Slight significance during both the construction and operation phases.

Groundwater

Groundwater Flow

9.4.9 The construction of embankments may result in localised compaction of superficial deposits resulting in localised potential impacts of negligible magnitude for groundwater flow within the superficial aquifers (the Tummel and Tay Sand and Gravel aquifer and the Isla and Lower Tay Sand and Gravel aquifer) both of which are of high value/importance). This is assessed as a potential effect of Slight significance on superficial aquifers for all proposed route options.

9.4.10 Based on information available at this stage of assessment, Table 9.10 indicates that three cuttings common to all proposed route options have the potential to intercept groundwater within the superficial deposits. Two of these cuttings also have the potential to intercept groundwater within the bedrock. This is expected to create a local dewatering effect within superficial and bedrock deposits, which would be negligible at the scale of the aquifer unit. The assessed potential impact and effect from these potential dewatering effects is summarised in Table 9.11 with a Slight effect significance for superficial and bedrock aquifers.

Table 9.11: Potential Dewatering Impacts and Effects on Groundwater Aquifers Common to All Route Options

Relevant Cutting ID	Groundwater Aquifer (SEPA identification)	Value/ Importance	Magnitude	Significance
C4, CS7 and Pond J (ST2A)/ Pond K (ST2B)/ Pond I (ST2C and ST2D)	Tummel and Tay Sand and Gravel aquifer (150735)	High	Negligible	Slight
	Killin, Aberfeldy and Angus Glens aquifer (150699)	Low	Negligible	Slight

Groundwater Quality

9.4.11 In the event of an accidental spillage during the construction or operational phases, potential contamination may migrate through the upper unsaturated zone reaching the shallow superficial/bedrock aquifer and impair groundwater quality, unless appropriate measures for control of discharge and drainage are taken.

9.4.12 The potential magnitude of impact from accidental spillages for all proposed route options is considered to be moderate adverse on superficial aquifers and minor adverse on bedrock aquifers. The potential impact and effect from accidental spillages on these aquifers is summarised in Table 9.12 with potential effect ranging from Slight to Large significance.

Table 9.12: Potential Impact and Effect of Accidental Spillages on Key Hydrogeological Units Common to All Route Options

Groundwater Aquifer (SEPA identification)	Value/ Importance	Magnitude	Significance
Isla and Lower Tay Sand and Gravel aquifer (150740)	High	Moderate adverse	**Large**
Tummel and Tay Sand and Gravel aquifer (150735)	High	Moderate adverse	**Large**
Killin, Aberfeldy and Angus Glens aquifer (150699)	Low	Minor adverse	Slight
Bankfoot aquifer (150657)	High	Minor adverse	**Moderate**

9.4.13 Potential impacts and effects of accidental spillages on surface water features are discussed in Volume 1, Part 3 - Environmental Assessment (Chapter 10: Road Drainage and the Water Environment).

Groundwater Reliant Receptors

9.4.14 Changes to groundwater quality and flow may have subsequent potential impacts upon groundwater reliant receptors such as groundwater abstractions and groundwater base flow to surface water features. The Sichardt method (Preene et al., 2016) was used to estimate the zone of influence of dewatering around each of the cuttings considered likely to intercept groundwater, using the dimensions of the cuttings and the estimated drawdown of groundwater levels due to the excavation. The assessed potential effect from groundwater impacts to these receptors is discussed in the following paragraphs.

Abstractions

9.4.15 No PWS have been identified in close proximity to any of the four proposed route options and therefore no PWS have been identified as at risk of water quality impairment due to accidental spillage. In addition, there are no PWS located in the vicinity of the predicted zone of influence of dewatering for each of the cuttings identified as common to all, and which are expected to intercept groundwater as per Table 9.10. Therefore, with respect to dewatering, no potential impacts or effects to PWS are predicted.

Surface Water

9.4.16 Potential surface water quality impairment or reduction in baseflow contribution, as a result of the potential impact on the groundwater environment, has been assessed based on the proximity of surface water features to areas where potential impacts on the groundwater environment could occur. It is assumed that a degree of hydraulic connectivity exists between the groundwater and surface water systems.

9.4.17 Surface water features are referenced as per the water feature (WF) numbering system presented in Volume 1, Part 3 - Environmental Assessment (Chapter 10: Road Drainage and the Water Environment). The value/importance of each surface water feature follows the guidance provided in Table 9.3 and reflects the hydrological importance of that surface water feature in supporting sensitive ecosystems.

9.4.18 A tiered assessment of potential impacts and effects on surface water features as a result of dewatering is provided within *Appendix A9.4: Surface Water Indirect Dewatering Assessment.* The initial tier adopted

a conservative and generic approach, identifying surface water features within the calculated zone of influence and deriving the potential magnitude of impact based on the expected groundwater drawdown. Surface water features with a potential initial effect significance of Moderate adverse or above then progressed to the second tier of assessment where a local ground model specific to each cutting was established to inform an updated assessment.

9.4.19 The findings from this tiered assessment established that, for surface water features in the common to all assessment, no significant potential effects were identified as a result of indirect dewatering.

Land Contamination

9.4.20 The assessment of potential contamination focused on the potential for impacts on receptors as a direct consequence of the four proposed route options encountering contamination. To support the DMRB Stage 2 assessment an evaluation of land contamination risk has been undertaken and is presented in *Appendix A9.3: Land Contamination Risk Assessment*.

9.4.21 The land contamination risk assessment has explored the plausible pollutant linkages associated with the direct and indirect disturbance of the 50 identified potential sources of land contamination and has provided an evaluation of risk based on the likelihood of the risk being present and the severity of the potential consequence should the risk be realised. The evaluation of risk has then been used to inform the magnitude of impact based on the criteria within Table 9.4.

Direct Disturbance

9.4.22 Direct disturbance of eight potential sources of land contamination (PBTC-C1, PBTC-C2, PBTC-C11, PBTC-C15, PBTC-C38, PBTC-C45, PBTC-C49 and various side roads) (refer *to Appendix A9.1: Potential Sources of Land Contamination within Study Area*) that are common to all proposed route options and the stockpiling of excavated materials associated with potential sources of land contamination could pose a land contamination risk to human health during both construction and operation. The evaluation of land contamination risk ranged from moderate risk to moderate/low risk during construction and from moderate/low risk to low risk during operation via a number of pollutant linkages involving the ingestion, inhalation and/or dermal contact with soil, soil dust, fibres (asbestos), vapours, deep and shallow groundwater and surface water. Based on the maximum evaluation of land contamination risk the magnitude of impact is considered to be Moderate during construction and Minor during operation.

9.4.23 The different human health receptor groups have been assigned a value reflective of the nature of typical land use. For example, long-term exposure and an increased number of plausible pollutant pathways are associated with residential land use whereas land used for transportation (highways/rail) will have a transient exposure to a reduced number of plausible pollutant pathways. Therefore, although the potential magnitude is the same, the effect significance for each receptor group is different. The predicted effect significance to human health via direct disturbance of potential sources of land contamination prior to essential mitigation is presented in Table 9.13.

Table 9.13: Potential Impacts and Effects to Human Health via Direct Disturbance Common to All Route Options

Receptor	DMRB Value	Construction		Operation	
		Magnitude	Significance	Magnitude	Significance
Residential	Very high	Moderate adverse	**Very large**	Minor adverse	**Large**
Construction/ Maintenance Workers	High		**Large**		**Moderate**
Open Space	High		**Large**		**Moderate**
Commercial/ Industrial	Medium		**Large**		Slight
Highways/Rail	Low		Slight		Slight

9.4.24 Direct disturbance and subsequent stockpiling of excavated materials associated with potential sources of land contamination could also pose a land contamination risk to the water environment via leaching and/or migration of contaminants/shallow groundwater, runoff and discharge of intercepted contaminated groundwater. The evaluation of land contamination risk predicted a moderate risk to the water environment during both construction and operation. Therefore, the magnitude of impact is considered to be Moderate. The predicted effect significance prior to essential mitigation for the identified Water Environment receptors is presented in Table 9.14.

Table 9.14: Potential Impacts and Effects to Water Environment via Direct Disturbance Common to All Route Options

Receptor	DMRB Value	Magnitude	Significance
Surface Water	Very high	Moderate Adverse	**Very large**
	High		**Large**
	Medium		**Large**
	Low		Slight
Isla and Lower Tay Sand and Gravel aquifer (150740)	High		**Large**
Tummel and Tay Sand and Gravel aquifer (150735)	High		**Large**
Bankfoot aquifer (150657)	High		**Large**
Killin, Aberfeldy and Angus Glens aquifer (150699)	Low		Slight

9.4.25 Throughout the study area depleted oxygen and concentrations of carbon dioxide and carbon monoxide above Health and Safety Executive (HSE) workplace exposure levels (WELs) (HSE, 2018) have been recorded. In addition, PID measurements potentially indicative of volatile vapours were encountered at two hotspots (both common to all proposed route options). As such, potential risks to construction and maintenance workers (high value) exist via migration and accumulation of ground gases during both construction and operation. The evaluation of land contamination risk determined a moderate risk during both construction and operation. Therefore, the magnitude of impact is considered to be Moderate adverse with a resultant effect significance of Large for construction and maintenance workers during construction and operation.

Indirect Disturbance

9.4.26 Indirect interactions may occur where proposed cuttings intercept groundwater, as they could draw contaminated groundwater towards the cutting. As explained earlier, the Sichardt method (e.g. Preene et al., 2016) was used to estimate the zone of influence of dewatering around each of the cuttings

considered likely to intercept groundwater, using the dimensions of the cuttings and the estimated drawdown of groundwater levels due to the excavation.

9.4.27 Three cuttings that are common to all have the potential to intercept groundwater: C4, CS7 and Pond J (Option ST2A)/Pond K (Option ST2B)/Pond I (Options ST2C and ST2D). Three potential contaminated land sources have been identified within the zone of influence of the cuttings, therefore, there is the potential for these three cuttings to draw in contaminated groundwater which would then need to be discharged to the water environment. The land contamination risk assessment has evaluated a Moderate/Low risk for both construction and operation. Therefore, the magnitude of impact is considered to be Minor adverse. The predicted effect significance prior to essential mitigation for the identified Water Environment receptors is presented in Table 9.15.

Table 9.15: Potential Impacts and Effects to Water Environment via Indirect Disturbance Common to All Route Options

Receptor	DMRB Value	Magnitude	Significance
Surface Water	Very high	Minor Adverse	**Large**
	High		**Moderate**
	Medium		Slight
	Low		Slight
Isla and Lower Tay Sand and Gravel aquifer (150740)	High		**Moderate**
Tummel and Tay Sand and Gravel aquifer (150735)	High		**Moderate**
Bankfoot aquifer (150657)	High		**Moderate**
Killin, Aberfeldy and Angus Glens aquifer (150699)	Low		Slight

9.4.28 Construction and maintenance personnel could be at risk through direct contact with the potentially drawn in contaminated groundwater (dermal contact and/or ingestion) at these three cuttings during construction and operation. The land contamination risk assessment evaluated a moderate/low risk during both construction and operation. Therefore, the magnitude of impact is considered to be Minor adverse with a resultant effect significance of Moderate.

9.4.29 It is considered unlikely that any ground gas present within the footprint of all proposed route options would be disturbed in such a way as to create new preferential pathways which would potentially impact human health receptors via indirect disturbance.

Impacts and Effects Specific to Option ST2A

9.4.30 Potential impacts and effects specific to Option ST2A in addition to the common to all impacts and effects relate to nine additional road cuttings and five additional SuDS cuttings as summarised in Table 9.16. Eight cuttings are considered likely to encounter bedrock and six cuttings are considered likely to encounter groundwater.

9.4.31 It should be noted that the proposed cut and cover tunnel section would be constructed using a top down construction technique as described in Volume 1, Part 2 - Engineering Assessment, Section 5.13 (Constructability). For this reason, the cut and cover tunnel is captured as a cutting activity (cutting C2) for the purpose of impacts on the geological, contaminated land and groundwater environment. Due to the length of this cutting (C2) and the variability of the geological and hydrogeological conditions, it was sub-divided into 3 sections: C2a, C2b and C2c and each section assessed individually.

Table 9.16: Option ST2A Specific Cutting Depths

Cutting ID	Approximate Chainage	Approximate Maximum Excavation Depth (m bgl)	Local Minimum Recorded Depth to Bedrock (m bgl)	Local Maximum Recorded Groundwater Level (m bgl)	Likelihood to Intercept Bedrock	Likelihood to Intercept Groundwater
C1	650 to 1650	10.8	23.0	10.5	Unlikely	Likely
C2: sub-zone C2a (mainline cut and cover tunnel)	1650 to 2450	16.2	1.6	21.0	Likely	Unlikely
C2: sub-zone C2b (mainline cut and cover tunnel)	2450 to 3200	11.7	7.0	9.0	Likely	Likely
C2: sub-zone C2c (mainline cut and cover tunnel)	3200 to 4000	15.5	6.5	7.0	Likely	Likely
CS1	2100 to 2200	2.0	1.6	29.0**	Likely	Unlikely
CS2	2200 to 2400	2.5	0.1	10.5	Likely	Unlikely
CS3	3450 to 3550	4.7	2.4	3.0	Likely	Likely
CS4	3750 to 3900	8.8	3.0	0.6	Likely	Likely
CS5	20 to 100**	4.8	27.0	10.0	Unlikely	Unlikely
CS6	0 to 40*	2.2	Deeper than 25	6.4	Unlikely	Unlikely
CS9	3300 to 3400	1.7	Deeper than 43.5	7.0	Unlikely	Unlikely
Pond A	10 to 90*	5	23	19.0	Unlikely	Unlikely
Pond B	20 to 120*	5.4	Deeper than 30	12.0**	Unlikely	Unlikely
Pond C	10 to 130*	16.7	0.1	10.5	Likely	Likely
Pond D	40 to 50*	1.1	6.2	3.0	Unlikely	Unlikely
Pond F	10 to 90*	3	Deeper than 25	6.4	Unlikely	Unlikely

*Side Road/Pond chainage, not mainline chainage.
**Local minimum recorded depth to bedrock and/or local maximum recorded depth to groundwater values extrapolated/estimated from available local GI data.

Soils

Agricultural Soils

9.4.32 Potential impacts and effects associated with the loss of agricultural soils that is specific to ST2A are presented in Table 9.17. The potential for an effect of Moderate significance has been identified for LCA Class 3.2 agricultural soils.

Table 9.17: Potential Impacts and Effects on Agricultural Soils for Option ST2A

Land Capability for Agriculture	LCA Class	Value/ Importance	Approximate Land-take (ha)	Magnitude	Significance
Prime agricultural land	3.1	High	0.9	Negligible	Slight
Non-prime agricultural land	3.2	Medium	5.7	Moderate	**Moderate**
	4.1 to 7	Low	1.3	Moderate	Slight

Geology

Superficial Geology

9.4.33 No potential impacts in addition to those presented as common to all proposed route options are identified for superficial geology.

Bedrock Geology

9.4.34 Although six of the proposed cuttings within Table 9.16 are assessed as likely to intercept bedrock, the resultant potential effect significance is unchanged from that presented in the common to all assessment (paragraph 9.4.8). Therefore, a potential effect significance of Negligible during both the construction and operation phases has been assessed.

Groundwater

Groundwater Flow

9.4.35 Five cuttings specific to Option ST2A (C1, C2 (sub zones C2b and C2c), CS3, CS4 and Pond C) have the potential to intercept groundwater (refer to Table 9.16) in addition to those identified as common to all (refer to Table 9.11). This is expected to create a local dewatering effect within the underlying superficial and bedrock deposits, which would be negligible at the scale of the aquifer unit. The assessed potential impact from these potential dewatering effects is provided in Table 9.18 with a Slight effect significance for superficial and bedrock aquifers.

Table 9.18: Potential Dewatering Impacts and Effects on Groundwater Aquifers for Option ST2A

Relevant Cutting ID	Groundwater Aquifer (SEPA identification)	Value/ Importance	Magnitude	Significance
C1, C2 (sub zones C2b and C2c), CS3, CS4 and Pond C	Isla and Lower Tay Sand and Gravel aquifer (150740)	High	Negligible	Slight
	Tummel and Tay Sand and Gravel aquifer (150735)	High	Negligible	Slight
C2 (sub zones C2b and C2c), CS3, CS4 and Pond C	Killin, Aberfeldy and Angus Glens aquifer (150699)	Low	Negligible	Slight

Groundwater Quality

9.4.36 No additional potential impacts to groundwater quality from accidental spillages specific to Option ST2A have been identified.

Groundwater Reliant Receptors

9.4.37 No predicted direct or indirect dewatering impacts to PWS, specific to Option ST2A.

9.4.38 The findings from the tiered assessment provided within *Appendix A9.4: Surface Water Indirect Dewatering Assessment* established that no significant potential effects upon surface water features as a result of indirect dewatering effects, specific to Option ST2A, were identified.

Land Contamination

Direct Disturbance

9.4.39 There are five additional potential sources of land contamination (PBTC-C3, PBTC-C22, PBTC-C29, PBTC-C30 and PBTC-C33) (refer *to Appendix A9.1: Potential Sources of Land Contamination within Study Area*) assessed as at risk of direct disturbance specific to Option ST2A. The evaluation of land contamination risk to human health ranged from moderate risk to moderate/low risk during construction and from moderate/low risk to low risk during operation via a number of pollutant linkages involving the ingestion, inhalation and/or dermal contact with soil, soil dust, fibres (asbestos), vapours, deep and shallow groundwater and surface water. Therefore, the effect significance is unchanged from that presented in the common to all assessment in Table 9.13 i.e. a potential effect of Very Large significance for residential land use areas, Large significance for construction activities, open space and commercial/industrial land use areas and Slight for highways/rail land use areas during construction and Large significance for residential land use areas, Moderate significance for maintenance activities and open space land use areas and Slight for commercial/industrial and highways/rail land use areas during operation.

9.4.40 The direct disturbance of these five additional potential sources of land contamination could also pose a risk to the water environment via leaching and/or migration of contaminants/shallow groundwater, runoff and discharge of intercepted contaminated groundwater. The land contamination risk evaluation of the pollutant linkages was a moderate risk to the water environment during both construction and operation. Therefore, the effect significance is unchanged from that presented in the common to all assessment in Table 9.14 i.e. a potential effect of Very Large significance for very high value surface waters, Large significance for high and medium value surface waters and groundwater aquifers and Slight for low value surface waters and groundwater aquifers.

9.4.41 Due to the potential presence of methane within the landfill cell at Ladywell Landfill (PBTC-C22) the evaluation of land contamination risk to construction and maintenance workers via migration and accumulation of ground gases during construction and operation is high risk. Therefore, the magnitude of impact is considered to be Major adverse with a resultant effect significance of Very Large for construction and maintenance workers during construction and operation.

Indirect Disturbance

9.4.42 Five cuttings specific to Option ST2A which have the potential to intercept groundwater (refer to Table 9.16) may also draw in contaminated groundwater from 13 potential sources of land contamination, including Ladywell Landfill (PBTC-C22), which then needs to be discharged to the water environment. The evaluation of land contamination risk to the water environment ranged from high risk, moderate risk, moderate/low risk to low risk. As the maximum potential land contamination risk is evaluated as High risk the magnitude of impact is considered to be Major adverse. Therefore, the effect is of Very Large significance for very high and high value surface waters and groundwater aquifers, Large significance for medium value surface waters and Moderate for low value surface waters and groundwater aquifers.

9.4.43 Construction and maintenance personnel could be at risk through direct contact with the potentially drawn in contaminated groundwater (dermal contact and/or ingestion) at these five cuttings during construction and operation. The land contamination risk assessment evaluated a moderate risk during both construction and operation. Therefore, the magnitude of impact is considered to be Moderate adverse with a resultant effect significance of Large.

Impacts and Effects Specific to Option ST2B

9.4.44 Potential impacts and effects specific to Option ST2B, in addition to the common to all assessment, relate to ten road cuttings and four additional SuDS cuttings as summarised in Table 9.19. Five cuttings are considered likely to encounter bedrock and five cuttings are considered likely to encounter groundwater.

Table 9.19: Option ST2B Specific Cutting Depths

Cutting ID	Approximate Chainage	Approximate Maximum Excavation Depth (m bgl)	Local Minimum Recorded Depth to Bedrock (m bgl)	Local Maximum Recorded Groundwater Level (m bgl)	Likelihood to Intercept Bedrock	Likelihood to Intercept Groundwater
C6	950 to 1650	6.2	23.0	10.5	Unlikely	Unlikely
C7*	2900 to 4000	9.9	6.5	7.0	Likely	Likely
CS3	3450 to 3550	4.7	2.4	3.0	Likely	Likely
CS4	3750 to 3900	8.8	3.0	0.6	Likely	Likely
CS5	20 to 100**	4.8	27.0	10.0	Unlikely	Unlikely
CS6	0 to 40**	2.2	Deeper than 25.0	6.4	Unlikely	Unlikely
CS9	3300 to 3400	1.7	Deeper than 43.5	7.0***	Unlikely	Unlikely
CS10	0 to 200	8.3	Deeper than 27.0	18.0***	Unlikely	Unlikely
CS11	700 to 750	1.2	Deeper than 30.0	18.0***	Unlikely	Unlikely
CS12	1950 to 2450	18.2	0.1	10.5	Likely	Likely
Pond A	10 to 70**	7.88	Deeper than 27.0	18.0***	Unlikely	Unlikely
Pond B	10 to 180**	24.25	0.1	10.5	Likely	Likely
Pond D	40 to 50**	1.2	6.2	3.0	Unlikely	Unlikely
Pond F	10 to 90**	3	Deeper than 40.5	6.4	Unlikely	Unlikely

*There is a large variance in recorded depth to bedrock and groundwater along the length of Cutting C7. The values shown in the table above are reflective of the highest likelihood of intercepting bedrock and groundwater across the length of the cutting.
**Side Road/Pond chainage, not mainline chainage.
***Local minimum recorded depth to bedrock and/or local maximum recorded depth to groundwater values extrapolated/estimated from available local GI data.

Soils

Agricultural Soils

9.4.45 Potential impacts and effects associated with the loss of agricultural soils that is specific to Option ST2B are presented in Table 9.20. The potential for an effect of Moderate significance has been identified LCA Class 3.2 agricultural soils.

Table 9.20: Potential Impacts and Effects on Agricultural Soils for Option ST2B

Land Capability for Agriculture	LCA Class	Value/ Importance	Approximate Land-take (ha)	Magnitude	Significance
Prime agricultural land	3.1	High	0.9	Negligible	Slight
Non-prime agricultural land	3.2	Medium	4.8	Moderate	**Moderate**
	4.1 to 7	Low	1.2	Moderate	Slight

Geology

Superficial Geology

9.4.46 No potential impacts in addition to those presented as common to all proposed route options are identified for superficial geology.

Bedrock Geology

9.4.47 Although five of the proposed cuttings within Table 9.19 are assessed as likely to intercept bedrock, the resultant potential effect significance is unchanged from that presented in the common to all assessment (paragraph 9.4.8) i.e. a potential effect significance of Negligible during both the construction and operation phases.

Groundwater

Groundwater Flow

9.4.48 Five cuttings specific to Option ST2B (C7, CS3, CS4, CS12 and Pond B) have the potential to intercept groundwater (as shown in Table 9.19) in addition to those identified as common to all (refer to Table 9.11). This is expected to create a local dewatering impact within the underlying superficial and bedrock deposits, which would be negligible at the scale of the aquifer unit. The assessed potential impact from potential dewatering is provided in Table 9.21 with a Slight effect significance for superficial and bedrock aquifers.

Table 9.21: Potential Dewatering Impacts and Effects on Groundwater Aquifers for Option ST2B

Relevant Cutting ID	Groundwater Aquifer (SEPA identification)	Value/ Importance	Magnitude	Significance
C7, CS3, CS4, CS12 and Pond B	Isla and Lower Tay Sand and Gravel aquifer (150740)	High	Negligible	Slight
	Tummel and Tay Sand and Gravel aquifer (150735)	High	Negligible	Slight
	Killin, Aberfeldy and Angus Glens aquifer (150699)	Low	Negligible	Slight

Groundwater Quality

9.4.49 No additional potential impacts to groundwater quality from accidental spillages specific to Option ST2B have been identified.

Groundwater Reliant Receptors

9.4.50 There are no predicted direct or indirect dewatering effect impacts to PWS specific to Option ST2B.

9.4.51 The findings from the tiered assessment provided within *Appendix A9.4: Surface Water Indirect Dewatering Assessment* established that no significant potential effects upon surface water features, as a result of indirect dewatering effects specific to Option ST2B, were identified.

Land Contamination

Direct Disturbance

9.4.52 There are three additional potential sources of land contamination (PBTC-C22, PBTC-C29 and PBTC-C33) which are assessed as at risk of direct disturbance specific to Option ST2B. The evaluation of land contamination risk to human health ranged from moderate risk to moderate/low risk during construction and from moderate/low risk to low risk during operation via a number of pollutant linkages involving the ingestion, inhalation and/or dermal contact with soil, soil dust, fibres (asbestos), vapours, deep and shallow groundwater and surface water. Therefore, the effect significance is unchanged from that presented in the common to all assessment in Table 9.13 i.e. a potential effect of Very Large significance for residential land use areas, Large significance for construction activities, open space and commercial/industrial land use areas and Slight for highways/rail land use areas during construction and Large significance for residential land use areas, Moderate significance for maintenance activities and open space land use areas and Slight for commercial/industrial and highways/rail land use areas during operation.

9.4.53 The direct disturbance of these three additional potential sources of land contamination could also pose a risk to the water environment via leaching and/or migration of contaminants/shallow groundwater, runoff and discharge of intercepted contaminated groundwater. The land contamination risk evaluation of the pollutant linkages was a moderate risk to the water environment during both construction and operation. Therefore, the effect significance is unchanged from that presented in the common to all assessment in Table 9.14 i.e. a potential effect of Very Large significance for very high value surface waters, Large significance for high and medium value surface waters and groundwater aquifers and Slight for low value surface waters and groundwater aquifers.

9.4.54 Due to the potential presence of methane within the landfill cell at Ladywell Landfill (PBTC-C22) the evaluation of land contamination risk to construction and maintenance workers via migration and accumulation of ground gases during construction and operation is high risk. Therefore, the magnitude of impact is considered to be Major adverse with a resultant effect significance of Very Large for construction and maintenance workers during construction and operation.

Indirect Disturbance

9.4.55 Five cuttings specific to Option ST2B which have the potential to intercept groundwater (as detailed in Table 9.19) may also draw in contaminated groundwater from 15 potential contaminated land sources, including Ladywell Landfill (PBTC-C22), which then needs to be discharged to the water environment. The evaluation of land contamination risk to the water environment ranged from high risk, moderate risk, moderate/low risk, low risk to very low risk. As the maximum potential land contamination risk is evaluated as High risk the magnitude of impact is considered to be Major. Therefore, the effect

significance is Very Large for very high and high value surface waters and groundwater aquifers, Large for medium value surface waters and Moderate for low value surface waters and groundwater aquifers.

9.4.56 Construction and maintenance personnel could be at risk through direct contact with the potentially drawn in contaminated groundwater (dermal contact and/or ingestion) at these five cuttings during construction and operation. The land contamination risk assessment evaluated a moderate risk during both construction and operation. Therefore, the magnitude of impact is considered to be Moderate with a resultant effect significance of Large.

Impacts and effects Specific to Option ST2C

9.4.57 Potential impacts and effects specific to Option ST2C in addition to the common to all assessment relate to nine additional road cuttings and five additional SuDS pond cuttings as summarised in Table 9.22. Three cuttings are considered likely to encounter bedrock and seven cuttings are considered likely to encounter groundwater.

Table 9.22: Option ST2C Specific Cutting Depths

Cutting ID	Approximate Chainage	Approximate Maximum Excavation Depth (m bgl)	Local Minimum Recorded Depth to Bedrock (m bgl)	Local Maximum Recorded Groundwater Level (m bgl)	Likelihood to Intercept Bedrock	Likelihood to Intercept Groundwater
C6	950 to 1600	6.2	23.0	10.5	Unlikely	Unlikely
CS10	900 to 1000	8.3	Deeper than 27.0	18.0**	Unlikely	Unlikely
CS11	700 to 750	1.2	Deeper than 30.0	18.0**	Unlikely	Unlikely
CS12	1950 to 2450	18.2	0.1	10.5	Likely	Likely
CS13	3500 to 4000	11.4	6.5	5.0**	Likely	Likely
CS14	3550 to 4000	8.4	22.0	8.0	Unlikely	Likely
CS15	25 to 225*	7.5	27.0	4.5	Unlikely	Likely
CS16	4000 to 4450	22.5	Deeper than 25.0	6.0	Unlikely	Likely
CS18	3300 to 3400	4.5	25.0	7.0	Unlikely	Unlikely
Pond A	10 to 70*	7.9	Deeper than 27.0	18.0**	Unlikely	Unlikely
Pond B	10 to 180*	24.25	0.1	10.5	Likely	Likely
Pond C1	10 to 40*	6.94	Deeper than 43.5	7.0	Unlikely	Unlikely
Pond C2	10 to 80*	5.1	30.0	18.0	Unlikely	Unlikely
Pond D	10 to 160*	9.3	Deeper than 40.5	6.0	Unlikely	Likely

*Side Road/Pond chainage, not mainline chainage.
**Local minimum recorded depth to bedrock and/or local maximum recorded depth to groundwater values extrapolated/estimated from available local GI data.

Soils

Agricultural Soils

9.4.58 Potential impacts and effects associated with the loss of agricultural soils that is specific to Option ST2C are presented in Table 9.23. The potential for effects of Moderate significance are assessed for LCA Class 3.2 agricultural soils.

Table 9.23: Potential Impacts and Effects on Agricultural Soils for Option ST2C

Land Capability for Agriculture	LCA Class	Value/ Importance	Approximate Land-take (ha)	Magnitude	Significance
Prime agricultural land	3.1	High	0.9	Negligible	Slight
Non-prime agricultural land	3.2	Medium	4.8	Moderate	**Moderate**
	4.1 to 7	Low	1.1	Moderate	Slight

Geology

Superficial Geology

9.4.59 No potential impacts in addition to those presented as common to all proposed route options are identified for superficial geology.

Bedrock Geology

9.4.60 Although three of the proposed cuttings within Table 9.22 are assessed as likely to intercept bedrock, the resultant potential impact is unchanged from that presented in the common to all assessment (paragraph 9.4.8) i.e. a potential effect of Negligible significance during both the construction and operation phases.

Groundwater

Groundwater Flow

9.4.61 Seven cuttings specific to Option ST2C (CS12, CS13, CS14, CS15, CS16, Pond B and Pond D) have the potential to intercept groundwater (as shown in Table 9.22) in addition to those identified as common to all (refer to Table 9.11). This is expected to create a local dewatering effect within the underlying superficial and bedrock deposits, which would be negligible at the scale of the aquifer. The assessed potential impact from these potential dewatering effects is provided in Table 9.24 with a Slight effect significance for superficial and bedrock aquifers.

Table 9.24: Potential Dewatering Impacts and Effects on Groundwater Aquifers for Option ST2C

Relevant Cutting ID	Groundwater Aquifer (SEPA identification)	Value/ Importance	Magnitude	Significance
CS12, CS13, CS14, CS15, CS16, Pond B and Pond D	Isla and Lower Tay Sand and Gravel aquifer (150740)	High	Negligible	Slight
	Tummel and Tay Sand and Gravel aquifer (150735)	High	Negligible	Slight
	Killin, Aberfeldy and Angus Glens aquifer (150699)	Low	Negligible	Slight

Groundwater Quality

9.4.62 No additional impacts to groundwater quality from accidental spillages specific to Option ST2C have been identified.

Groundwater Reliant Receptors

9.4.63 There are no predicted direct or indirect dewatering effect impacts to PWS specific to Option ST2C.

9.4.64 The findings from the tiered assessment provided within *Appendix A9.4: Surface Water Indirect Dewatering Assessment* established that no significant potential effects upon surface water features as a result of indirect dewatering effects specific to Option ST2C were identified.

Land Contamination

Direct Disturbance

9.4.65 There are two additional potential sources of land contamination (PBTC-C18 and PBTC-C29) which are assessed as at risk of direct disturbance specific to Option ST2C. The evaluation of land contamination risk to human health ranged from moderate risk to moderate/low risk during construction and from moderate/low risk to low risk during operation via a number of pollutant linkages involving the ingestion, inhalation and/or dermal contact with soil, soil dust, fibres (asbestos), vapours, deep and shallow groundwater and surface water. Therefore, the effect significance is unchanged from that presented in the common to all assessment in Table 9.13 i.e. a potential effect of Very Large significance for residential land use areas, Large significance for construction activities, open space and commercial/industrial land use areas and Slight for highways/rail land use areas during construction and Large significance for residential land use areas, Moderate significance for maintenance activities and open space land use areas and Slight for commercial/industrial and highways/rail land use areas during operation.

9.4.66 The direct disturbance of these two additional potential sources of land contamination could also pose a risk to the water environment via leaching and/or migration of contaminants/shallow groundwater, runoff and discharge of intercepted contaminated groundwater. The land contamination risk evaluation of the pollutant linkages was a moderate risk to the water environment during both construction and operation. Therefore, the effect significance is unchanged from that presented in the common to all assessment in Table 9.14 i.e. a potential effect of Very Large significance for very high value surface waters, Large significance for high and medium value surface waters and groundwater aquifers and Slight for low value surface waters and groundwater aquifers.

9.4.67 The potential risks to construction and maintenance workers (high value) via the migration and accumulation of ground gases during both construction and operation is unchanged from that presented in the common to all assessment i.e. a potential effect of Large significance.

Indirect Disturbance

9.4.68 Seven cuttings specific to Option ST2C which have the potential to intercept groundwater (as detailed in Table 9.22) may also draw in contaminated groundwater from 21 potential sources of land contamination, including Ladywell Landfill (PBTC-C22), which then needs to be discharged to the water environment. The evaluation of land contamination risk to the water environment ranged from moderate risk, moderate/low risk, low risk to very low risk. Therefore, the effect significance is unchanged from that presented in the common to all assessment in Table 9.15 i.e. a potential effect of Very Large significance for very high value surface waters, Large significance for high and medium value surface waters and groundwater aquifers and Slight for low value surface waters and groundwater aquifers.

9.4.69 Construction and maintenance personnel could be at risk through direct contact with the potentially drawn in contaminated groundwater (dermal contact and/or ingestion) at these seven cuttings during construction and operation. The land contamination risk assessment evaluated a moderate risk during both construction and operation. Therefore, the magnitude of impact is considered to be Moderate adverse with a resultant effect significance of Large.

Impacts and Effects Specific to Option ST2D

9.4.70 Potential impacts and effects specific to Option ST2D in addition to the common to all assessment relate to eight additional road cuttings and four additional SuDS pond cuttings as summarised in Table 9.25. Two cuttings are considered likely to encounter bedrock and three cuttings are considered likely to encounter groundwater.

Table 9.25: Option ST2D Specific Cutting Depths

Cutting ID	Approximate Chainage	Approximate Maximum Excavation Depth (m bgl)	Local Minimum Recorded Depth to Bedrock (m bgl)	Local Maximum Recorded Groundwater Level (m bgl)	Likelihood to Intercept Bedrock	Likelihood to Intercept Groundwater
C6	950 to 1600	6.2	23.0	10.5	Unlikely	Unlikely
C9	3550 to 4000	5.2	6.5	4.0	Unlikely	Likely
CS5	20 to 100	4.8	27.0	10.0	Unlikely	Unlikely
CS6	0 to 40	2.2	Deeper than 25.0	6.4	Unlikely	Unlikely
CS10	900 to 1000	8.3	Deeper than 27.0	18.0**	Unlikely	Unlikely
CS11	700 to 750	1.2	Deeper than 30.0	18.0**	Unlikely	Unlikely
CS12	1950 to 2450	18.2	0.1	10.5	Likely	Likely
CS18	3300 to 3400	4.5	25.0	7.0	Unlikely	Unlikely
Pond A	10 to 70*	7.88	Deeper than 27.0	18.0**	Unlikely	Unlikely
Pond B	10 to 180*	24.25	0.1	10.5	Likely	Likely
Pond C	10 to 40*	6.94	Deeper than 43.5	7.0	Unlikely	Unlikely
Pond D	10 to 90*	3.01	Deeper than 40.5	6.4	Unlikely	Unlikely

*Side Road/Pond chainage, not mainline chainage.
**Local minimum recorded depth to bedrock and/or local maximum recorded depth to groundwater values extrapolated/estimated from available local GI data.

Soils

Agricultural Soils

9.4.71 Potential impacts and effects associated with the loss of agricultural soils that is specific to Option ST2D are presented in Table 9.26. The potential for an effect of Moderate significance has been identified for LCA Class 3.2 soils.

Table 9.26: Potential Impacts and Effects on Agricultural Soils for Option ST2D

Land Capability for Agriculture	LCA Class	Value/ Importance	Approximate Land-take (ha)	Magnitude	Significance
Prime agricultural land	3.1	High	0.9	Negligible	Slight
Non-prime agricultural land	3.2	Medium	4.8	Moderate	**Moderate**
	4.1 to 7	Low	1.1	Moderate	Slight

Geology

Superficial Geology

9.4.72 No potential impacts in addition to those presented as common to all proposed route options are identified for superficial geology.

Bedrock Geology

9.4.73 Although two of the proposed cuttings within Table 9.25 are assessed as likely to intercept bedrock, the resultant potential impact is unchanged from that presented in the common to all assessment (paragraph 9.4.8) with potential effect of Negligible significance during both the construction and operation phases.

Groundwater

Groundwater Flow

9.4.74 Three cuttings specific to Option ST2D (C9, CS12 and Pond B) have the potential to intercept groundwater (as shown in Table 9.25) in addition to those identified as common to all (refer to Table 9.12). This is expected to create a local dewatering effect within the underlying superficial and bedrock deposits, which would be negligible at the scale of the aquifer. The assessed potential impact from potential dewatering is provided in Table 9.27 with a Slight effect significance for superficial and bedrock aquifers.

Table 9.27: Potential Dewatering Impacts and Effects on Groundwater Aquifers for Option ST2D

Relevant Cutting ID	Groundwater Aquifer (SEPA identification)	Value/ Importance	Magnitude	Significance
C9, CS12 and Pond B	Isla and Lower Tay Sand and Gravel aquifer (150740)	High	Negligible	Slight
	Killin, Aberfeldy and Angus Glens aquifer (150699)	Low	Negligible	Slight

Groundwater Quality

9.4.75 No additional potential impacts to groundwater quality from accidental spillages specific to Option ST2D have been identified.

Groundwater Reliant Receptors

9.4.76 No predicted direct or indirect dewatering impacts to PWS, specific to Option ST2D.

9.4.77 The findings from the tiered assessment provided within *Appendix A9.4: Surface Water Indirect Dewatering Assessment* established that no significant potential effects upon surface water features as a result of indirect dewatering effects specific to Option ST2D were identified.

Land Contamination

Direct Disturbance

9.4.78 There are three additional potential sources of land contamination (PBTC-C18, PBTC-C29 and PBTC-C33) which are assessed as at risk of direct disturbance specific to Option ST2D. The evaluation of land contamination risk to human health ranged from moderate risk to moderate/low risk during construction

and from moderate/low risk to low risk during operation via a number of pollutant linkages involving the ingestion, inhalation and/or dermal contact with soil, soil dust, fibres (asbestos), vapours, deep and shallow groundwater and surface water. Therefore, the effect significance is unchanged from that presented in the common to all assessment in Table 9.13 i.e. a potential effect of Very Large significance for residential land use areas, Large significance for construction activities, open space and commercial/industrial land use areas and Slight for highways/rail land use areas during construction and Large significance for residential land use areas, Moderate significance for maintenance activities and open space land use areas and Slight for commercial/industrial and highways/rail land use areas during operation.

9.4.79 The direct disturbance of these three additional potential sources of land contamination could also pose a risk to the water environment via leaching and/or migration of contaminants/shallow groundwater, runoff and discharge of intercepted contaminated groundwater. The land contamination risk evaluation of the pollutant linkages was a moderate risk to the water environment during both construction and operation. Therefore, the effect significance is unchanged from that presented in the common to all assessment in Table 9.14 i.e. a potential effect of Very Large significance for very high value surface waters, Large significance for high and medium value surface waters and groundwater aquifers and Slight for low value surface waters and groundwater aquifers.

9.4.80 The potential risks to construction and maintenance workers (high value) via the migration and accumulation of ground gases during both construction and operation is unchanged from that presented in the common to all assessment i.e. a potential effect of Large significance.

Indirect Disturbance

9.4.81 Three cuttings specific to Option ST2D which have the potential to intercept groundwater (as detailed in Table 9.25) may also draw in contaminated groundwater from 11 potential sources of land contamination, including Ladywell Landfill (PBTC-C22), which then needs to be discharged to the water environment. The evaluation of land contamination risk to the water environment ranged from moderate risk, moderate/low risk to low risk. Therefore, the effect significance is unchanged from that presented in the common to all assessment in Table 9.15 i.e. a potential effect of Very Large significance for very high value surface waters, Large significance for high and medium value surface waters and groundwater aquifers and Slight for low value surface waters and groundwater aquifers.

9.4.82 Construction and maintenance personnel could be at risk through direct contact with the potentially drawn in contaminated groundwater (dermal contact and/or ingestion) at these three cuttings during construction and operation. The land contamination risk assessment evaluated a moderate risk during both construction and operation. Therefore, the magnitude of impact is considered to be Moderate adverse with a resultant effect significance of Large.

9.5 Potential Mitigation

9.5.1 DMRB Stage 2 is focussed on route options assessment, therefore, the detailed design has not been developed and detailed mitigation cannot be defined. The objective of this section is to identify 'generic' or 'anticipated' mitigation taking into account best practice, legislation and guidance. This mitigation is taken into account in Section 9.6 (Summary of Options Assessment) to provide a basis for comparative assessment and selection of the Preferred Route Option to be taken forward to assessment at DMRB Stage 3. Potential mitigation measures are described below for each subheading.

Soils

9.5.2 The assessment has identified the potential for significant effects on agricultural soils. Specific mitigation measures with respect to agricultural soils would be developed during the DMRB Stage 3

assessment with the aim of protecting, where practicable, the agricultural capability of land and soils. Generic mitigation measures may include:

- Development of a Soil Management Plan prior to construction, for implementation during construction. This shall include consideration of the selection of appropriate construction methodologies to limit the areas and volume of agricultural soils to be disturbed and/or excavated to a minimum during construction to limit the impact.
- Soil resources to be managed in accordance with the Construction Code of Practise for the Sustainable Use of Soils on Construction Sites (Defra, 2009). This will include the careful excavation, storage and replacement of topsoil and subsoil.
- A record of condition survey is to be undertaken of any land to be returned to agriculture, to ensure all land is restored as near to its original condition as is reasonably practicable.

9.5.3 Although mitigation measures are not required for peat, to ensure there are no localised detrimental effects if peat was to be encountered during construction, measures such as excavation, storage and re-use would be considered, taking cognisance of 'Development on Peatland: Guidance on the Assessment of Peat Volumes, Reuse of Excavated Peat and the Minimisation of Waste' (Scottish Renewables and SEPA, 2012) and compliance with relevant waste management practices under The Waste Management Licensing (Scotland) Regulations 2011 as amended (Scottish Government, 2011a; 2011b).

Geology

9.5.4 Potential geological effects for all proposed route options are of Negligible to Slight significance and so mitigation measures beyond the embedded mitigation and good practice measures are not considered essential.

Groundwater

Groundwater Quality

9.5.5 Volume 1, Part 3 - Environmental Assessment (Chapter 10: Road Drainage and the Water Environment) provides details on anticipated mitigation to address potential effects on surface waters, including adherence to SEPA Guidance for Pollution Prevention (GPP) series during construction, and appropriate Sustainable Drainage Systems (SuDS) during operation. These measures would also mitigate against water pollution risk to groundwater by reducing the potential for pollutant release and preventing any contaminated runoff from entering groundwater via the unsaturated zone. These mitigation measures would also protect groundwater receptors against effects on water quality.

9.5.6 Road drainage aspects of the scheme (such as filter drains or SuDS) may also require to be lined, depending on the location of these in relation to sensitive groundwater receptors.

Groundwater Flow and associated Groundwater Receptors

9.5.7 In excavation areas confirmed to intercept groundwater, the level of impact on associated receptors such as groundwater abstractions and surface water features would be further assessed at DMRB Stage 3. Thereafter, specific mitigation measures would be put in place where required. The DMRB Stage 3 assessment would also be supported by further consultation with landowners on PWS.

9.5.8 The DMRB Stage 3 assessment and the mitigation measures proposed would be placed within the context and potential requirement of obtaining groundwater abstraction CAR licencing for these activities.

Land Contamination

9.5.9 Direct and indirect disturbance of identified potential sources of land contaminated is expected for all proposed route options. This interaction could lead to direct and indirect potential effects to human health and the water environment, which have been predicted to range from Very Large to Slight significance. Where significant contamination is confirmed, a risk assessment would be undertaken as part of the DMRB Stage 3 assessment; and mitigation, if required, would be specified on a site-specific basis. SEPA's Land Remediation and Waste Management Guidelines (SEPA, 2016b) would be referred to where appropriate. Mitigation measures may include:

- storage of excavated made ground material using bunded facilities and development of re-use criteria;
- removal of contaminated soils from site;
- consolidation for treatment ex-situ; and/or,
- treatment in situ (of soil and/or water).

9.5.10 Prior to (and during) construction, measures to control/remove the predicted impacts and effects of construction would be developed and recorded within documents such as a Code of Construction Practise (CoCP), a Construction Environmental Management Plan (CEMP), a Construction Phase Health and Safety Plan as well as task specific Risk Assessments and Method Statements (RAMS). As a last resort, Personal Protective Equipment (PPE) would be adopted to protect workers from direct interaction with any potential contaminated soil, contaminated groundwater, ground gas or other hazardous substances, for example, asbestos.

9.5.11 It is anticipated that specific mitigation measures in addition to those listed above would need to be developed at Ladywell Landfill (PBTC-C22) for Options ST2A and ST2B. Both options involve the direct disturbance of land which is governed by a Waste Management Licence (WML). This direct disturbance would require the full or partial surrender of the WML, and consequently alteration of the associated working plan. This would involve dialogue with licence holder and site operator, PKC, and the regulator, SEPA. This process is likely to involve a combination (but not necessarily all) of the following:

- further GI;
- formation and delivery of a remediation strategy (if necessary);
- subsequent monitoring period (length to be determined in discussion with SEPA and PKC) to demonstrate no residual environmental risks exist; and
- alteration of current landfill infrastructure to accommodate revised site layout (if a partial surrender is applied for).

9.5.12 In addition, the potential indirect effect of drawing contaminated water from Ladywell Landfill towards areas of cuttings, is applicable for all proposed route options. The requirement for specific mitigation measures such as treatment of groundwater prior to discharge would be determined after detailed design.

9.5.13 Waste management procedures, such as those within a Site Waste Management Plan (SWMP) and/or CEMP, would be put in place during construction as discussed in Volume 1, Part 3 - Environmental Assessment (Chapter 18: Material Assets and Waste), Section 18.5.

9.6 Summary of Route Options Assessment

9.6.1 This section provides a summary of the DMRB Stage 2 assessment of potential effects for the proposed route options taking into account the anticipated potential mitigation as described in Section 9.5 (Potential Mitigation).

9.6.2 For the comparison of proposed route options, two aspects are considered; whether the potential for residual effects would be considered significant in the context of the EIA Regulations; and whether any of the potential impacts and effects identified differ sufficiently between proposed route options such that they can be considered a differentiator and need to be considered as part of the overall identification of the Preferred Route Option, which takes into account environmental considerations as well as engineering, economic and traffic considerations.

9.6.3 Residual effects on geology, soils and groundwater are discussed below and a summary of assessment is provided in Table 9.28. A comparative assessment of all proposed route options is shown in Table 9.29.

9.6.4 The minor differences between the proposed route options with respect to soils, geology, groundwater and associated groundwater receptors are not considered sufficient to be considered differentiators.

9.6.5 With regard to land contamination, it is anticipated that potential risks associated with development of brownfield sites could be managed during construction and operation and therefore mitigated for all identified potential sources of land contamination. However, Options ST2A and ST2B involve the direct disturbance of Ladywell Landfill (PBTC-C22) which is governed by a WML. This direct disturbance would require the full or partial surrender of the WML and, consequently, alteration of the associated working plan. This would involve dialogue with licence holder and site operator, PKC, and the regulator, SEPA. This process is likely to involve a combination (but not necessarily all) of the following:

- further GI;
- formation and delivery of a remediation strategy (if necessary);
- subsequent monitoring period (length to be determined in discussion with SEPA and PKC) to demonstrate no residual environmental risks exist; and
- alteration of current landfill infrastructure to accommodate revised site layout (if a partial surrender is applied for).

9.6.6 It would take time, and agreement between all relevant stakeholders, to complete the above processes.

9.6.7 Options ST2C and ST2D would not involve direct disturbance of Ladywell Landfill. Therefore, they would not require the surrender of the WML or alteration of the working plan and are likely to progress more quickly.

9.6.8 Whilst not a difference in terms of significance of potential effect on land contamination between proposed route options this is considered a differentiator in the procedure for developing land within the curtilage of Ladywell Landfill and a comparative assessment is reported in Table 9.28.

Table 9.28: Summary of Assessment - Geology, Soils and Groundwater

Chapter/Subcategory			Residual Effects				Comments
			Option ST2A	Option ST2B	Option ST2C	Option ST2D	
Geology, Soils and Groundwater	Construction and Operation	Soils	Potential effects of Moderate significance on 5.7ha of LCA Class 3.2 agricultural soils.	Potential effects of Moderate significance on 4.8ha of LCA Class 3.2 agricultural soils.	Potential effects of Moderate significance on 4.8ha of LCA Class 3.2 agricultural soils.	Potential effects of Moderate significance on 4.8ha of LCA Class 3.2 agricultural soils.	The differences between the proposed route options are not considered sufficient to be a differentiator.
		Geology	No significant effect				The differences between the proposed route options are not considered sufficient to be a differentiator.
		Groundwater quality (spillages, SuDS)	No significant effect				No differences between the proposed route options.
		Groundwater abstractions (PWS)	No significant effect				No differences between the proposed route options.
		Groundwater baseflow to surface water features	No significant effects				The differences between the proposed route options are not considered sufficient to be a differentiator.
		Land Contamination	Options ST2A and ST2B would involve the direct disturbance of Ladywell Landfill which is governed by a Waste Management Licence (WML). This direct disturbance would require the full or partial surrender of the WML. Therefore, the development of land within the curtilage of Ladywell Landfill would have additional time and cost implications for the project.		Options ST2C and ST2D do not involve direct disturbance of Ladywell Landfill. Therefore, they do not require the surrender of the Waste Management Licence and are likely to progress more quickly and at a lower cost.		There are no differentiators in terms of potential for significant effects. However, the procedure for developing land within the curtilage of an active WML (Ladywell Landfill) would have time and cost implications for Options ST2A and ST2B. This difference is considered sufficient to be a differentiator between the proposed route options.

Compliance Against Plans and Policies

9.6.9 DMRB LA 104 states that environmental assessment, reporting and monitoring shall meet the requirements of the national planning policy for each relevant Overseeing Organisation.

9.6.10 *Appendix A21.1 (Assessment of Policy Compliance)* provides a review of national, regional and local policy documents which are of relevance to this assessment undertaken and reported in this chapter in accordance with DMRB guidance.

9.6.11 National Planning Policy objectives (and accompanying best practice guidance) of relevance to this assessment are provided in National Planning Framework 3 (NPF3) (Scottish Government, 2014b), Scottish Planning Policy (SPP) (Scottish Government, 2014a; Revised 2020) theme *Valuing the Natural Environment*, as well as PAN 33 (Development of Contaminated Land) (Scottish Government, 2016). In addition, local policies of relevance include Perth and Kinross Local Development Plan 2 (PKC LDP2) (PKC, 2019) Policies 51 (Soils) and 58 (Contaminated Land and Unstable Land) as well as TAYplan Policy 9 (Managing TAYplan's Assets) (TAYplan, 2017).

9.6.12 A full policy compliance assessment can be found in Table 2 of *Appendix A21.1 (Assessment of Policy Compliance)*. It is assessed that although impacts are found in relation to agricultural soil and land contamination, mitigation has been proposed and will be further developed at DMRB Stage 3. At this stage it is anticipated that all proposed route options would comply with relevant national, regional and local policies in relation to Geology, Soils and Groundwater.

Community Objectives

9.6.13 There are no specific contributions to meeting the community objectives identified for Geology, Soils and Groundwater. Further details on contributions to the community objectives from other environmental topics are detailed in *Appendix A7.1: Mapping of Community Objectives Against DMRB Stage 2 Route Options* and the relevant chapters within Volume 1, Part 3 - Environmental Assessment of this DMRB Stage 2 Report.

Comparative Assessment

9.6.14 Although there are no differentiators identified in terms of potential effect significance with respect to land contamination, there is a significant difference in the procedure required for developing land within the curtilage of Ladywell Landfill, due to the governance of the WML. Options ST2A and ST2B both include infrastructure within the curtilage of Ladywell Landfill, they are considered to have the highest overall effect and conversely Options ST2C and ST2D, which remain outside the curtilage of Ladywell Landfill, are considered to have the lowest overall effect in relation to land contamination.

Table 9.29: Summary of Comparative Assessment

Route Option	Lowest Overall Effect	Intermediate Overall Effect	Highest Overall Effect
Option ST2A			✓
Option ST2B			✓
Option ST2C	✓		
Option ST2D	✓		

9.7 Scope of DMRB Stage 3 Assessment

9.7.1 It is proposed that the Stage 3 assessment for Geology, Soils and Groundwater would be undertaken in accordance with the DMRB. It is anticipated the Stage 3 assessment would include the following:

- input into scheme design and identification of mitigation as appropriate;
- detailed assessment of dewatering effects in proposed areas of cuttings;
- assessment of GWDTE in line with Land Use Planning System SEPA Guidance Note 31 (SEPA 2017);
- further consultation with landowners and potential surveys to identify and mitigate private water supplies potentially at risk;
- further consultation with landowners and potential site visits to confirm the location and network of septic tanks and septic tank discharge points;
- further stakeholder consultation with respect to potential Ladywell Landfill constraints, if Options ST2A and ST2B were selected as the Preferred Route Option;
- consideration of opportunities for land to be returned to agriculture; and
- development of mitigation proposals to reduce impacts of permanent loss or sealing of agricultural soils.

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10 Road Drainage and the Water Environment

10.1 Introduction

10.1.1 This chapter presents the Design Manual for Roads and Bridges (DMRB) Stage 2 assessment of the proposed route options in terms of the following aspects of the surface water environment: flood risk, hydromorphology, surface water quality and surface water supply.

10.1.2 This chapter also considers road drainage insofar as is feasible at this stage of assessment. Roads are designed to drain freely to prevent build-up of standing water on the carriageway whilst avoiding exposure to or causing flooding. Contaminants deposited on the road surface are washed off during rainfall events and can be collected through the drainage system and discharged to the receiving water environment.

Legislative and Policy Background

10.1.3 The following paragraphs report the key legislation and policies of relevance to this chapter. An assessment of the compliance of the proposed route options against national to local planning policies and plans relevant to this environmental topic is reported in Volume 1, Part 3 – Environmental Assessment (Chapter 21: Policies and Plans and *Appendix A21.1 (Assessment of Policy Compliance)*).

Water Environment and Water Services (Scotland) Act 2003 (WEWSA)

10.1.4 The Water Framework Directive (WFD) (2000/60/EC) was transposed into Scottish law under the Water Environment and Water Services (Scotland) Act 2003 (WEWSA). WEWSA enables provisions to be made for protecting the water environment in connection with implementing the Directive. Under the WFD, new activities should not cause deterioration (of the ecological and chemical status of surface and groundwater bodies) or prevent the achievement of overall Good Ecological Status (GES) or Potential (GEP), for artificial or heavily modified water bodies.

The Water Environment (Controlled Activities) (Scotland) Regulations 2011 (as amended) and The Water Environment (Miscellaneous) (Scotland) Regulations 2017

10.1.5 The WEWSA gives Scottish Ministers power to regulate activities in the water environment (both surface waters and groundwater). This is achieved under The Water Environment (Controlled Activities) (Scotland) Regulations 2011 (as amended) (Scottish Government, 2013) (hereafter referred to as CAR) and The Water Environment (Miscellaneous) (Scotland) Regulations 2017 (Scottish Government, 2017). This legislation controls engineering works within inland surface waters, as well as point source discharges, abstractions and impoundments.

10.1.6 There are four separate regulatory regimes, namely engineering, pollution control, abstractions and impoundments. Without going through a derogation process, CAR will not permit a downgrade of status on any classified water body or permit activities that will prevent good status being achieved by 2027.

10.1.7 The Water Environment (Miscellaneous) (Scotland) Regulations 2017 provides further updates to the CAR process whereby discharges to the water environment from construction sites will require a CAR Licence. These regulations also formally revoke The Water Environment (Oil Storage) Regulations 2006 (Scottish Government, 2006a).

Flood Risk Management (Scotland) Act 2009

10.1.8 The EU Floods Directive (2007/60/EC) is transposed into Scottish law through the Flood Risk Management (Scotland) Act 2009 (FRMA) (Scottish Government, 2009b). The FRMA sets in place a

statutory framework for delivering a sustainable and risk-based approach to the management of flooding, including the preparation of assessments of the likelihood and impacts of flooding, and associated catchment focussed plans.

10.1.9 The FRMA places a duty on responsible authorities (Scottish Ministers, SEPA, Scottish Water and local authorities) to manage and reduce flood risk and promote sustainable flood risk management. The main elements of the FRMA, which are relevant to the planning system, are the assessment of flood risks and undertaking structural and non-structural flood management measures.

Scottish Planning Policy (SPP)

10.1.10 Through the FRMA, SPP (Scottish Government, 2014a; Revised 2020) requires planning authorities to consider all sources of flooding (coastal, fluvial, pluvial, groundwater, reservoirs, sewers and blocked culverts) and their associated risks when preparing development plans and reviewing planning applications.

10.1.11 The aims of SPP in relation to flooding are:

- to prevent developments which would be at significant risk of being affected by flooding;
- to prevent developments which would increase the probability of flooding elsewhere; and
- to provide a risk framework from which to identify a site's flood risk category and the related appropriate planning response.

10.1.12 This approach places planning in the wider context of Scottish Government aims and policies. SPP does not restate policy and guidance used elsewhere but should consider the wider policy framework including the National Planning Framework in decision making.

10.2 Approach and Methods

Structure of Assessment

10.2.1 The assessment of potential impacts and effects on the surface water environment in this chapter includes:

- Flood Risk: potential impacts on the flow of water above ground and the risk of flooding from all sources;
- Hydromorphology: the importance of, and potential impacts upon, fluvial landforms associated with river systems, and the flow and sediment transport processes which create and sustain them. Note for the purposes of this assessment, hydromorphology focuses on fluvial morphology only;
- Surface Water Quality: potential impacts on the quality of the water from construction and operational runoff of pollutants, including both acute impacts from soluble pollutants and chronic impacts from sediment related pollutants, and from spillage events; and
- Surface Water Supply: potential impacts on the quality and quantity of surface water fed water supplies.

10.2.2 The attributes of the surface water environment above are intrinsically linked. They are also linked to groundwater and ecological receptors, considered in Volume 1, Part 3 – Environmental Assessment (Chapter 9: Geology, Soils and Groundwater and Chapter 11: Biodiversity), respectively. Commercial and recreational use of the water environment is considered in Volume 1, Part 3 – Environmental Assessment (Chapter 8: Population – Land Use). The specialist teams undertaking each of these assessments worked closely to cover interactions between these topics and cross-referencing is provided throughout this chapter where relevant.

10.2.3 The approach and methods have been informed by the recommendations made in the A9 Dualling Programme Strategic Environmental Assessment (SEA) (Transport Scotland, 2013, 2014b, 2014c). For flood risk, the primary recommendation was that avoidance of the 0.5% Annual Exceedance Probability (200-year) flood extent should be balanced against impacts on other environmental receptors that could arise as a result. In addition, there were recommendations that consultation with the Scottish Environment Protection Agency (SEPA) should be undertaken to discuss the assessment of impacts and the requirements for flood risk assessment, Sustainable Drainage Systems (SuDS) and requirements under CAR.

Study Area

10.2.4 The baseline study area for this assessment covers the footprints and 500m from the outermost edge of all the proposed route options. For flood risk, the study area is determined by the natural processes of the water feature (WF) and floodplain and the location of flood receptors, which can extend for some distance from the proposed route options. The hydrological inputs to this study area are affected by processes within the upper River Tay catchment. The 500m study area, including identified water features, existing crossing points and flood inundation extents is shown on Figures 10.1 to 10.4. For ecological designations, refer to Figure 11.1 and 11.2.

Baseline Conditions

10.2.5 Baseline conditions were identified through a combination of consultation with relevant stakeholders, desk-based assessment and site walkovers.

Desk-based Assessment

10.2.6 The desk-based assessment has considered relevant DMRB guidance, legislation, and regulations, including those listed below:

- European Commission (2000). Council Directive (2000/60/EC) Water Framework Directive;
- DMRB LA 104 'Environmental assessment and monitoring' Revision 1 (Highways England et al, 2020b), hereby referred to as DMRB LA 104;
- DMRB LA 113 'Road Drainage and the Water Environment', Revision 1 (Highways England et al., 2020c), hereby referred to as DMRB LA 113;
- Water Environment Water Services (WEWS) Act 2003 (Scottish Government, 2003);
- The Water Environment (Controlled Activities) (Scotland) Regulations 2011 (as amended) (CAR) (Scottish Government, 2013);
- The Water Environment (Miscellaneous) (Scotland) Regulations 2017;
- Scottish Planning Policy (SPP) (Scottish Government, 2014a; Revised 2020);
- The Climate Change (Scotland) Act 2009 (Scottish Government, 2009a);
- The Flood Risk Management (Scotland) Act 2009 (Scottish Government, 2009b);
- Technical Flood Risk Guidance for Stakeholders (SS-NFR-P-002) (SEPA, 2019a); and
- Water Framework Directive (WFD) policy guidance 'The Future for Scotland's Waters, Guiding Principles on the Technical Requirements of the Water Framework Directive' (SEPA, 2002).

10.2.7 The results of previous assessments were also utilised, including the DMRB Stage 1 assessment report (A9 Dualling: Preliminary Engineering Support (PES) (Transport Scotland, 2014a)) and related Strategic Environmental Assessment documents (Transport Scotland, 2013; 2014b; 2014c).

10.2.8 Data were collated from the following sources:

- Aerial photography (Transport Scotland, 2017).
- Ordnance Survey (OS) Maps (1:25,000 Explorer Maps 379 & 386), and 1:1,250 to 1:10,000 MasterMap data.
- Online/web-based historical maps.
- British Geological Survey (BGS) Digital Mapping.
- LIDAR topographical survey data.
- Flood Estimation Handbook (FEH) CD-ROM Version 3, Centre for Ecology and Hydrology (CEH, 2009).
- SEPA Flood Maps (SEPA, 2020a).
- SEPA RBMP data and classification results available on the SEPA Water Environment Hub (SEPA, 2020b) and the SEPA Water Classification Hub (SEPA, 2020c).

Surveys

10.2.9 Surveys of the study area were undertaken in April 2015, October 2016, February 2017, August 2018 and February 2019 to visually inspect surface water features to gain an understanding of the local topography, catchment hydrology and to gather field data for the flood risk, hydromorphology and surface water quality assessments. Conditions during and leading up to the surveys were variable as these were undertaken in a range of seasons; this led to a range of observed flow conditions.

10.2.10 Surface water catchment areas derived from the FEH (CEH, 2009) were also investigated if uncertainty was identified regarding the catchment boundary, and LiDAR data, OS maps and topographical survey data were used to check and adjust the FEH boundaries as necessary.

10.2.11 A number of other surveys were undertaken, including river channel cross-section and hydraulic structure surveys using conventional topographical survey techniques, and inspections of minor culverts crossing the existing A9.

Consultation

10.2.12 A summary of the consultation undertaken is reported in Volume 1, Part 3 – Environmental Assessment (Chapter 7: Overview of Environmental Assessment, Section 7.6 (Consultation)). Key consultations that have informed this assessment are summarised in the following paragraphs.

10.2.13 In addition to the scheme-wide guidance provided through the Environment Steering Group (ESG) and responses to the SEA, consultations of particular relevance to this assessment were undertaken with regulatory bodies and key stakeholders including SEPA. SEPA provided the following information to inform the baseline and assessment stages:

- water quality data for monitored water bodies;
- licensed abstractions and discharges to water bodies; and
- historical flood flows, flood area extents and river flow data.

10.2.14 Advice and guiding principles from SEPA have been taken into consideration during the design and assessment stages.

10.2.15 Flood issues have been a focus of local drop-in sessions and the public exhibition process, using these opportunities to capture local evidence and concerns. Discussions with attendees have focussed on the nature of observed flooding extents, structure condition and maintenance and potential cumulative effects of other development proposals in addition to the A9 Dualling Programme.

Inchewan Burn

10.2.16 Initial consultation with SEPA took place in September 2018 concerning the proposals to vertically realign Inchewan Burn as required for Options ST2A and ST2B. During this consultation, SEPA stated that these proposals were unlikely to be compliant with CAR and may require a derogation.

10.2.17 A derogation is required where significant adverse impacts on the water environment are anticipated, which contravenes the principles of River Basin Management Planning and therefore does not comply with 'The river basin management plan for the Scotland river basin district: 2015 – 2027' (SEPA, 2015) or the WEWS Act (and therefore the WFD). Further detail on the derogation process is outlined in SEPA Regulatory Method (WAT-RM-34) Derogation Determination – Adverse Impacts on the Water Environment (SEPA, 2017).

10.2.18 Further consultation with SEPA took place in November 2018. As the catchment area of Inchewan Burn falls below 10km^2, it is not a classified water body (non-baseline water body) under WFD. However, under CAR any engineering activities on the watercourse remain subject to SEPA Environmental Standards tests (in particular the Single Activity Limits and local scale 500m assessment), which determine whether engineering activities would result in a deterioration in morphological quality.

10.2.19 Proposals to lower Inchewan Burn as required for Options ST2A and ST2B may fail the Environmental Standards tests and would therefore invoke a Good Practice Test. The basic principles of the Good Practice Test are to demonstrate need for the engineering works, consider a range of options (with the selected option that causes the least ecological harm at a cost that is not disproportionately expensive), and includes mitigation. The CAR determination process is then dependent on whether SEPA considers there to be third party interests. Should SEPA consider there to be no third party interests and on the basis that Option ST2A and ST2B could comply with the Good Practice Test, determination of the licence could proceed (provided SEPA also consider that conservation interests are not at risk). If SEPA consider there to be no third-party interests, on the basis that Options ST2A and ST2B could comply with the Good Practice Test, the proposals can move forward to derogation.

10.2.20 SEPA would consider CAR authorisation for works through derogation if the proposals comply with a set of conditions, referred to as derogation tests (as detailed in SEPA, 2017). The tests are applied where there is a risk of a deterioration in hydromorphology, hydrology, ecology or surface water quality.

Flood Modelling and Hydrological Assessment

10.2.21 To improve the understanding of the baseline flood conditions and facilitate an accurate assessment of likely impacts, a flood model was developed for the River Tay (WF6) and its larger tributaries within the study area. Estimates of flow for the assessment scenario (the 1 in 200 year flood, plus a 20% allowance for climate change) were calculated using the Flood Estimation Handbook (FEH) statistical and rainfall runoff methods for small catchments, and analysis using SEPA river flow gauge data for the larger watercourses.

10.2.22 The model developed for this project extended from the crossing of the existing A9 at Jubilee Bridge at the northern end of the project extents to Boat of Murthly at the southern end, including the River Braan (WF11) and Inchewan Burn (WF8). The hydraulic model was developed using Flood Modeller Pro software to represent the river channel and TUFLOW software to represent the surrounding floodplain. The model is intended to provide a comparative assessment at DMRB Stage 2 and would be developed and refined at DMRB Stage 3. The flood extents based on Jacobs refined flood modelling are shown on Figures 10.1 to 10.4.

10.2.23 Given the number of smaller watercourses crossed by the project, these were subject to a more simplified level of assessment at DMRB Stage 2. Design flows were used in combination with channel capacities calculated from survey data to determine the current risk posed to sensitive receptors nearby, and the

impact of the extension/replacement of structures crossing the watercourse to facilitate carriageway widening were assessed. This screening approach has identified sites where potential impacts may occur and that would require further detailed assessment at DMRB Stage 3, including more detailed localised numerical hydraulic modelling to refine the assessment of flood risk performed at DMRB Stage 2.

10.2.24 Once a baseline was established, the proposed route options were included in the models to predict the impacts of the options. The results of this work are contained within the A9 Dualling Programme: Pass of Birnam to Tay Crossing DMRB Stage 2 – Flood Risk Assessment (Transport Scotland, 2021) and have been used to undertake the impact assessment reported in this chapter.

Assessment of Impacts and Effects

10.2.25 The assessment of impacts and effects has been undertaken using the general approach outlined in the following paragraphs, where the level of significance of an effect is assessed based on the importance of the surface water feature and the magnitude of potential impact. This is in accordance with the methodology provided in DMRB LA 113.

10.2.26 In the absence of specific methodologies for the assessment of hydromorphology with respect to road developments, the assessment of hydromorphology impacts and effects was undertaken using standard good practice and guidance notes from SEPA and research and development programmes of the River Restoration Centre, Environment Agency (EA) and SNH, including:

- SEPA (WAT-SG-21) Environmental Standards for River Morphology (SEPA, 2012a);
- The Scottish Rivers Handbook (CREW, 2013);
- The Fluvial Design Guide (Environment Agency, 2010);
- Manual of River Restoration Techniques (RRC, 2013);
- Applied Fluvial Geomorphology for River Engineering and Management (Thorne et al. 1997); and
- Guidebook of Applied Fluvial Geomorphology (Sear et al., 2010).

<u>Importance</u>

10.2.27 The importance of a water feature was categorised on a scale of 'Low' to 'Very High', using professional judgement guided by the criteria provided in Table 10.1 in line with Table 3.70 of DMRB LA 113. The attributes of surface water features considered include flood risk, hydromorphology, surface water quality and surface water supply, in line with DMRB LA 113 guidance.

10.2.28 It is noted that DMRB LA 104 uses the term 'Environmental value (sensitivity)' when assigning value to a receptor, however this chapter uses the term 'Importance' in line with DMRB LA 113. It is also noted that DMRB LA 104 includes a category for receptors of 'Negligible' Environmental value (sensitivity), however this category is not included in DMRB LA 113 and is therefore not considered within this chapter.

10.2.29 For flood risk, the importance was based on SEPA Flood Risk and Land Use Vulnerability Guidance, hereafter referred to as SEPA LUPS-GU24 (SEPA, 2018). The level of importance (Very High, High, Medium and Low) was assigned to watercourses taking into account the likelihood of flooding to identified receptors during the 0.5% AEP (200-year) plus CC event and translates directly to the vulnerability classification contained within the SEPA LUPS-GU24. Most Vulnerable Uses include both civil infrastructure and land uses defined as most vulnerable in line with Scottish Planning Policy (Scottish Government, 2020a).

10.2.30 The importance assessment of surface water quality was informed by the WFD water body physico-chemical and biological elements status, and specific pollutant and/or priority substances status

published by SEPA (to meet WEWSA requirements) on its Water Environment Hub (SEPA, 2020c) and Water Classification Hub (SEPA, 2020b) websites. Where no WFD data exists for smaller/minor water features, potential deterioration of water quality from anthropogenic pressures and/or pollutant inputs from discharges (licenced under CAR) and/or surrounding land-use relative to flow volume is assessed. In addition, Q_{95} flows (the flow that is expected to be exceeded 95% of the time) and the presence of any protected/designated sites are used in the assessment.

10.2.31 Surface Water Supply is assessed Very High or High importance only in relation to the number of properties/receptors a water resource is supplying.

Table 10.1: Importance criteria and examples

Importance	DMRB LA 113 Typical Examples	Applicable Scheme Examples
Very High	**Nationally significant attribute of high importance.**	
	Surface water: Watercourse having a WFD classification shown in a RBMP and Q_{95} ≥ 1.0m³/s. **Site**: protected/designated under EC or UK legislation (SAC, SPA, SSSI, Ramsar site, salmonid water)/species protected by EC legislation. **Flood risk:** Essential infrastructure or highly vulnerable development.	**Flood Risk**
		Most Vulnerable Land Uses, including critical/essential infrastructure as defined in SEPA LUPS-GU24 (SEPA, 2018 at risk from flooding during the 0.5% AEP (200-year) plus CC event.
		Hydromorphology
		WFD classified water body achieving 'High' morphology status. WFD classified water body considered to be sensitive to additional morphological pressures as it is within 2.5% of a morphological condition limit boundary (e.g. High/Good, Good/Moderate, Moderate/Poor). Non WFD classified watercourses may be applicable if they demonstrate qualities such as: a channel in stable equilibrium and exhibiting a range of natural morphological features (such as pools, riffles and bars); diversity in morphological processes reflects unconstrained natural function; free from artificial modification or anthropogenic influence.
		Surface Water Quality
		WFD classified water body achieving 'High' physico-chemical and biological elements status, 'Pass' for specific pollutants and /or priority substances. Q_{95} likely to be ≥ 1.0m³/s. Watercourse part of a site protected/designated under International/EC/EU or UK legislation (SAC, SPA, SSSI, Ramsar site). Non WFD classified watercourses may be applicable if part of a protected site.
		Surface Water Supply
		Water resource extensively exploited for public, private domestic and/or agricultural and/or industrial use, feeding ten or more properties.
High	**Locally significant attribute of high importance.**	
	Surface water: Watercourse having a WFD classification shown in an RBMP and Q_{95} <1.0m³/s. **Flood risk:** More vulnerable development.	**Flood Risk**
		Highly Vulnerable Land Uses as defined in SEPA LUPS-GU24 (SEPA, 2018) at risk from flooding during the 0.5% AEP (200-year) plus CC event.
		Hydromorphology
		WFD classified water body achieving or having established RBMP objectives (for a later RBMP cycle) to achieve 'Good' morphology status. Non WFD classified watercourses may be applicable if they demonstrate qualities such as: a channel achieving near-stable equilibrium and exhibiting a range of natural morphological features (such as pools, riffles and bars); diversity in

Importance	DMRB LA 113 Typical Examples	Applicable Scheme Examples
		morphological processes reflects relatively unconstrained natural function, with minor artificial modification or anthropogenic influence.
		Surface Water Quality
		WFD classified water body achieving or having established RBMP objectives (for a later RBMP cycle) to achieve 'Good' physico-chemical and biological elements status ('Good potential' for HMWBs), 'Pass' for specific pollutants and /or priority substances. Q_{95} likely to be <1.0m³/s. Contains species protected under EC or UK legislation but is not part of a protected site. Non WFD classified water bodies may be applicable if protected species are present, indicating good water quality and supporting habitat.
		Surface Water Supply
		Valuable water supply resource due to exploitation for public, private domestic and/or agricultural and/or industrial use, feeding fewer than 10 properties.
Medium	**Of moderate quality and rarity.**	
	Surface water: Watercourses not having a WFD classification shown in an RBMP and Q_{95} >0.001m³/s. **Flood risk:** Less vulnerable development.	**Flood Risk**
		Least Vulnerable Land Uses as defined in SEPA LUPS-GU24 (SEPA, 2018) at risk from flooding during the 0.5% AEP (200-year) plus CC event.
		Hydromorphology
		Water body not classified under WFD. A channel currently showing signs of historical or existing modification and artificial constraints. attempting to recover to a natural equilibrium and exhibiting a limited range of natural morphological features (such as pools, riffles and bars).
		Surface Water Quality
		Water body not classified under WFD. May have a number of anthropogenic pressures and/or pollutant inputs from discharges (licenced under CAR) and/or surrounding land-use relative to flow volume. Q_{95} likely to be >0.001m³/s.
Low	**Lower quality.**	
	Surface water: Water body not having a WFD classification shown in a RBMP and Q_{95} ≤0.001m³/s **Flood risk:** Water compatible development.	**Flood Risk**
		Water Compatible Land Uses as defined in SEPA LUPS-GU24 (SEPA, 2018) at risk from flooding during the 0.5% AEP (200-year) plus CC event.
		Hydromorphology
		Water body not classified under WFD. A channel currently showing signs of extensive historical or existing modification and artificial constraints. There is no evidence of diverse fluvial processes and morphology and active recovery to a natural equilibrium.
		Surface Water Quality
		Water body not having a WFD classification shown in a RBMP. May have a large number of anthropogenic pressures and/or pollutant inputs from discharges (licenced under CAR) and/or surrounding land-use relative to flow volume. Q_{95} likely to be ≤0.001m³/s.

Impact Magnitude

10.2.32 The impact magnitude is influenced by the timing, scale, size, and duration (long term, temporary or permanent) of change to the baseline conditions, as well as likelihood of occurrence of the potential impact, as defined in Table 10.2. As detailed design information regarding construction activities and

watercourse crossings is not yet available, the magnitude of construction impacts is based on the general type and extent of channel engineering/modification and number of works likely to be required in the channel and floodplain.

10.2.33 Identification of impact magnitude for the water environment also takes account of the likelihood of occurrence or how regularly a given event or outcome would occur. Many potential impacts would only be realised during extreme events, for example low probability storm events or major spills.

HEWRAT Calculations

10.2.34 As referenced in Table 10.2, potential impact magnitude for water quality during the operational phase is informed by the outputs of Highways England's Water Risk Assessment Tool (HEWRAT), which has been developed to assess the magnitude of potential short-term impacts of routine runoff on surface waters.

10.2.35 HEWRAT also estimates in-river annual average concentrations for soluble pollutants (dissolved copper and dissolved zinc), which can be compared against published Environmental Quality Standards (EQS) values to assess whether there is likely to be a long-term impact on aquatic ecology. Sediment-bound pollutants and the ability of the receiving water feature to disperse sediment is also considered; if sediment is predicted to accumulate, the potential extent of sediment coverage is also identified.

10.2.36 Model inputs include the area of hard surfacing from which runoff would be collected, predicted traffic flows, rainfall/site data and the dilution provided by the receiving water feature. Model outputs confirm a 'pass' or 'fail' depending on whether the risk is within or exceeds the published thresholds; in any instances where a 'fail' result is registered, the proposed scheme drainage design would be discussed with SEPA through DMRB Stage 3 in order to ensure adequate protection of the water environment. The HEWRAT assessment is based on a three-step approach:

- Step 1 assesses the concentration of untreated and undiluted road runoff;
- Step 2 predicts the concentrations of pollutants after mixing within the receiving water body; and
- Step 3 includes the risk reduction associated with any existing or proposed SuDS measures.

10.2.37 As there are differences in the drainage designs between proposed route options, an assessment of operational impacts and effects relating to routine runoff was carried out in line with in DMRB LA 113 to determine whether these differences presented a differentiator between proposed route options. The assessment of the magnitude of operational impacts has considered the nature of the water features proposed to receive road drainage and outputs from HEWRAT.

10.2.38 It is noted that DMRB LA 104 includes a category for 'No change', however this category is not included in DMRB LA 113 and is therefore not considered within this chapter.

Table 10.2: Magnitude of Impact Criteria – Surface Water Features

Magnitude	DMRB LA 113 Criteria	Applicable Scheme Examples
Major adverse	Results in loss of attribute and/or quality and integrity of the attribute.	**Flood Risk**
		Major changes to flow regime (low, mean and/or high flows – at the site, upstream and/or downstream). An alteration to a catchment area in excess of a 25% reduction or increase. An increase in peak flood level (0.5% AEP) >100mm. Significant increase in the extent of "medium to high risk" areas (classified by the Risk Framework of SPP). This means there would be significantly more areas/properties at risk from flooding by the 0.5% or greater AEP (200-year) plus Climate Change (CC) event.
		Hydromorphology
		More than one new watercourse crossing or structure (including outfalls) required, significantly increasing the extent of watercourse modification. Significant channel realignment from the existing planform or new/extended embankments and/or bridge abutments proposed within the river corridor. This could significantly alter the nature of the fluvial, sedimentological and geomorphological processes within a reach and at a wider catchment scale.
		Surface Water Quality
		Two or more in-channel works and significant/cumulative works in the vicinity of a water feature or within a catchment resulting in a major shift away from baseline conditions. The downgrade in WFD quality status of a water feature as this contravenes the WFD. Failure of both soluble and sediment-bound pollutants in HEWRAT assessment, and compliance failure against EQS values.
		Surface Water Supply
		Total loss or extensive change to a fishery, water supply or designated conservation site.
Moderate adverse	Results in effect on integrity of attribute, or loss of part of attribute.	**Flood Risk**
		Moderate shift away from baseline conditions and moderate changes to the flow regime. An alteration to a catchment area in excess of 10% but less than 25%. Moderate increase in the extent of "medium to high risk" areas (SPP). An increase in peak flood level (0.5% AEP) >10mm resulting in an increased risk of flooding to >100 residential properties OR an increase of >50mm resulting in an increased risk of flooding to 1-100 residential properties.
		Hydromorphology
		A single additional watercourse crossing, or structure required, increasing the extent of watercourse modification. The extension of an existing embankment or bridge abutment set back from the river banks or channel realignment. This could alter the nature of the fluvial, sedimentological and geomorphological processes within a reach and potentially at a wider catchment scale.
		Surface Water Quality
		Up to two in-channel works resulting in a moderate shift away from baseline conditions. Failure of both soluble and sediment-bound pollutants in HEWRAT, but compliance with EQS values.
		Surface Water Supply
		Partial loss in productivity of a fishery or water supply.

Magnitude	DMRB LA 113 Criteria	Applicable Scheme Examples
Minor adverse	Results in some measurable change in attributes, quality or vulnerability.	**Flood Risk**
		Slight changes to the flow regime. An alteration to a catchment area in excess of 1% but less than 10%. Slight increase in the extent of 'medium to high risk' areas (SPP). An increase in peak flood level (0.5% AEP) >10mm resulting in an increased risk of flooding to fewer than 10 industrial properties.
		Hydromorphology
		Upgrade to, or extension of, existing watercourse crossing or structure, with minor channel realignment required. This would result in a less substantial deviation from baseline conditions than adding an entirely new structure or new section of channel. This could locally alter the nature of the fluvial, sedimentological and geomorphological processes.
		Surface Water Quality
		One in-channel works or construction/extension of a bridge with no in-channel piers or abutments resulting in a minor shift away from baseline conditions. Failure of either soluble or sediment-bound pollutants in HEWRAT, but compliance with EQS values.
Negligible	Results in effect on attribute, but of insufficient magnitude to affect the use or integrity	**Flood Risk**
		Negligible changes to the flow regime (i.e. changes that are within the monitoring errors). An alteration to a catchment area of less than 1% reduction or increase in area. Negligible change in peak flood level (0.5% AEP) <+/-10mm. Negligible change in the extent of 'medium to high risk' areas (SPP).
		Hydromorphology
		No direct engineering impact but potential indirect impact due to proximity of the watercourse to the proposed route options, such as pollution by sediment release or reduction in riparian corridor.
		Surface Water Quality
		No in-channel works resulting in no perceptible changes to water quality. No risk identified by HEWRAT (Pass both soluble and sediment-bound pollutants).
Minor beneficial	Results in some beneficial effect on attribute or a reduced risk of negative effect occurring	**Flood Risk**
		Minor improvement over baseline conditions. It would involve a reduction in peak flood level (0.5% AEP) >10mm.
		Hydromorphology
		Slight improvement of the river channel from baseline conditions as a consequence of the works. *Note: beneficial impacts* would *only arise on impacted/modified/artificial water features. The greatest improvement* would *occur on water features that have a uniform morphology, acting as a transfer (larger watercourses) or sink (minor watercourses with limited flow and overgrown vegetation) of sediment and no signs of active fluvial processes*.
		Surface Water Quality
		Minor improvement in water quality attributes over baseline conditions. HEWRAT Pass for either soluble or sediment-bound pollutants where the baseline (existing) was a Fail condition.
Moderate beneficial	Results in moderate improvement of attribute quality	**Flood Risk**
		A moderate improvement over baseline conditions involving a reduction in peak flood level (0.5% AEP) >50mm.

Magnitude	DMRB LA 113 Criteria	Applicable Scheme Examples
		Hydromorphology
		Improvement to a watercourse as a result of the works through means of some restoration or mitigation. This could provide a moderate improvement from baseline conditions.
		Surface Water Quality
		Moderate improvement in water quality attributes over baseline conditions. HEWRAT Pass for both soluble and sediment-bound pollutants where the baseline (existing) was a Fail condition.
Major beneficial	Results in major improvement of attribute quality	**Flood Risk**
		Major improvement over baseline conditions. The reduction in peak flood level (0.5% AEP) is to be >100mm.
		Hydromorphology
		Significant improvement to a watercourse as a result of substantial restoration or mitigation. This could provide a major improvement from baseline conditions.
		Surface Water Quality
		Major improvement in water quality attributes over baseline conditions, whereby the removal or likelihood of removal of existing pressures achieves compliance with WFD.

Significance of Effect

10.2.39 The significance of an effect is determined as a function of the importance of the water feature and the magnitude of impact, as outlined in Table 10.3. For the purposes of this assessment, effects of Moderate significance and above are considered to be 'significant' in the context of this assessment. As per DMRB LA 104 and LA113, where there are two alternatives provided in the table, a single significance rating has been chosen based on professional judgement. Typically, the higher significance rating is reported, following the precautionary principle, however where the lower significance is reported, justification is provided.

Table 10.3: Matrix for Determination of Impact Significance*

Magnitude / Importance	Negligible	Minor	Moderate	Major
Very High	Slight	**Moderate or Large**	**Large or Very Large**	**Very Large**
High	Slight	Slight or **Moderate**	**Moderate or Large**	**Large or Very Large**
Medium	Neutral or Slight	Slight	**Moderate**	**Moderate or Large**
Low	Neutral or Slight	Neutral or Slight	Slight	Slight or **Moderate**

*Note the above matrix has been adapted from Table 3.8.1 of DMRB LA 104 and does not include a magnitude of 'No Change' or an importance of 'Negligible' as these categories are not included in DMRB LA 113.

Community Objectives

10.2.40 At an early stage in the A9 Co-Creative Process, the Birnam to Ballinluig A9 Community Group generated community objectives. The seven community objectives are presented in Volume 1, Part 3 – Environmental Assessment (Chapter 7: Overview of Environmental Assessment) and cover a wide range of topics but focus predominantly on environmental issues.

10.2.41 The community objectives have been taken into consideration throughout the DMRB Stage 2 process, and a mapping exercise was conducted to indicate how, in the operational phase, the proposed route options could contribute to the relevant objectives. Details of how each environmental topic contributes towards achieving the community objectives are presented in *Appendix A7.1: Mapping of Community Objectives Against DMRB Stage 2 Route Options* and a summary for this chapter is presented in Section 10.6.

Limitations to Assessment

10.2.42 It should be noted that this DMRB Stage 2 assessment was prepared prior to and during the global COVID-19 coronavirus pandemic. Throughout 2020 and in early 2021, there have been significant and extensive restrictions in place in Scotland on the movement of people and the activities that are permitted. Due to the duration and extent of such restrictions, some of the baseline and survey updates have not been achievable.

10.2.43 The existing A9 has relatively low traffic flows (and proportional volume of heavy goods vehicles) towards the lower end of the range used in the assessment of spillage risk contained in DMRB LA 113. As a result, it is anticipated that the annual exceedance probability (spillage risk return period) of a spillage event would fall well below published thresholds for this project. A spillage risk assessment has therefore not been performed at this assessment stage as it is unlikely to be a differentiator between the proposed route options for this assessment. However, a full DMRB spillage risk assessment will be undertaken and reported at DMRB Stage 3 based on the Preferred Route Option in line with DMRB LA 113.

10.2.44 This assessment has partly used the SEPA Flood Maps (SEPA, 2020a) to inform the baseline, although it is recognised that the maps have limitations. A detailed flood model has been constructed to refine the information presented in the SEPA Flood Maps for this project. This is based on elevation data derived from LiDAR and topographic surveys and developed from previous work undertaken by AECOM (formerly URS), which would require further refinement at DMRB Stage 3. The models provide a comparison between proposed route options and relative impacts, rather than an absolute impact at this stage.

10.2.45 Not all of the design elements of the development are included in the flood models at present. Drainage systems and SuDS basins would be further developed during DMRB Stage 3 and would be included within the models to support the development of the Preferred Route Option and the final Flood Risk Assessment.

10.3 Baseline Conditions

10.3.1 Within the 500m study area of the proposed route options there are 21 water features, which range from large waterbodies with European-level ecological designations to minor straightened road and field drains, which provide only a functional land drainage benefit.

10.3.2 All of the identified water features within the southern section projects have been referenced sequentially from south to north. Of the 21 water features, there are two large water features which are monitored by SEPA under WFD (referred to by SEPA as baseline water bodies), as follows:

- River Tay (Reach: R Tummel to R Isla confluences) (WF6), which has a total catchment area of 3,210km^2; and
- River Braan (WF11), which has a catchment area of 211km^2.

10.3.3 These two water features are part of the River Tay Special Area of Conservation (SAC), designated primarily for Atlantic salmon; sea lamprey, brook lamprey, river lamprey and otter are also qualifying features of the site.

10.3.4 There is also one smaller watercourse that is not monitored by SEPA under WFD (non-baseline water body), Inchewan Burn (WF8). Inchewan Burn is a tributary of the River Tay and rises in the Obney Hills to the west of Birnam where elevations reach 403 meters above ordnance datum (mAOD). It flows north-east for approximately 5.77km and discharges into the River Tay at approximate NGR NO 03187 42230. In its lower reaches, Inchewan Burn is crossed by the Highland Main Line railway, existing A9 and Perth Road (B867) as it flows through Birnam. The watercourse displays a low sinuosity planform with steep step-pool, tumbling and uniform/rapid flow types and is connected to, but not a component of, the River Tay SAC. The section between the Highland Main Line railway bridge to the downstream side of the existing A9 bridge crossing has been the focus of previous restoration attempts aimed at improving fish habitat quality and passability within the channel. These improvements were completed in 2007 and are now used as an example of river restoration techniques by the River Restoration Centre (RRC, 2013).

10.3.5 Table 10.4 provides a summary of the baseline classification of each attribute for all water features potentially affected by the proposed route options within the 500m study area. A description of the baseline conditions to inform the classification, including photographs of all water features is provided in *Appendix A10.1: RDWE Baseline Conditions.* For two of the proposed route options (ST2A and ST2B), extensive works are required on Inchewan Burn (WF8), therefore a more detailed baseline is provided in *Appendix A10.2: Inchewan Burn.* Related information on groundwater and private water supplies (PWS) is provided in Volume 1, Part 3 – Environmental Assessment (Chapter 9: Geology, Soils and Groundwater) and ecological designations and protected species in Volume 1, Part 3 – Environmental Assessment (Chapter 11: Biodiversity).

10.3.6 Photographs 10.1 to 10.6 provide examples of the range of water features and their typical size identified within the study area.

10.3.7 The locations of the water features and corresponding identification reference (IDs) (Table 10.4), water feature crossing points and flood inundation extents are shown on Figures 10.1 to 10.4. For ecological designations, refer to Figures 11.1 and 11.2.

10.3.8 From the SEPA consultation responses received to date, there are a number of licenced surface water discharges, abstractions and other engineering works affecting four water features within the study area, which include:

- River Tay (WF6):
  - four private septic tank effluent discharges (NGR NO 04302 40815, NO 04168 41411, NO 03505 42035 and NO 03211 42233);
  - six combined sewer overflow discharges (NGR NO 04181 41355, NO 04106 41556, NO 03923 41749, NO 03170 42224, NO 02634 42443 and NO 02617 42444);
  - three emergency overflow of sewage discharges (NGR NO 03935 41739, NO 03178 42250 and NO 02634 42443);
  - four sewage treatment works discharges (NGR NO 04259 41038, NO 01706 42362 NO 01195 42479 and NO 00419 44213); and
  - one abstraction for agricultural irrigation (mobile plant) at Inchmagrannachan Farm (NGR NO 00449 44434).

- Inchewan Burn (WF8): Engineering works (channel straightening) (NGR NO 03007 41711).
- River Braan (WF11): One private septic tank effluent discharge (NGR NO 01552 42140).
- Mill Stream (WF12): One private sewage treatment works discharge (NGR NO 01718 42235).

10.3.9 The baseline for flooding has been developed from the flood modelling and screening calculations undertaken for this project, in conjunction with the SEPA Flood Maps (SEPA, 2020a). Greater emphasis has been placed on the results of the detailed flood modelling for this project than the SEPA Flood Maps when determining baseline conditions. The baseline flood extents based on Jacobs refined flood modelling, as shown on Figures 10.1 to 10.4, were updated to consider the impacts and effects of the proposed route options.

Surface Water Supply

10.3.10 There is one surface water supply abstraction from the River Tay within the study area, an agricultural abstraction for irrigation (mobile plant) at Inchmagrannachan Farm (approximate NGR, NO 00449 44434). This is considered to be of high importance.

Existing Road Drainage Network

10.3.11 Treatment of routine runoff from the existing A9 between Pass of Birnam and Tay Crossing is generally limited, consisting of kerbs and gullies which direct untreated road runoff to an outfall into the nearest water feature.

10.3.12 In certain areas there are lengths of filter drain in the verges that provide initial (one SuDS level) of treatment for runoff from the road and/or adjacent earthworks slopes.

Photograph 10.1: River Tay (WF6) – view upstream towards Dunkeld and Birnam (example of a large WFD waterbody)

Photograph 10.2: River Braan (WF11) – view upstream from footbridge, immediately upstream of A9 bridge crossing (example of a medium/large WFD waterbody).

Photograph 10.3: Inchewan Burn (WF8) – upstream view of restored section underneath A9 bridge (example of a medium water feature).

Photograph 10.4: Water feature 9 (WF9) – downstream view from existing A9 culvert outlet toward Dunkeld and Birnam Recreation Club (example of a small water feature).

Photograph 10.5: Water feature 13 (WF13) – upstream view of WF13, upstream of the existing A9 (example of a small water feature).

Photograph 10.6: Water feature 4 (WF4) – downstream view from B867 towards A9 (example of a drainage channel).

Table 10.4: Summary of water feature importance

Water Feature ID (water body name)	Photograph Reference	Size/type	Attribute		
			Flood Risk	Hydromorphology	Surface Water Quality
WF6 (River Tay)	Photograph 10.1	Large WFD waterbody	Very High	High	Very High
WF1 (Birnam Burn)	Refer to Appendix A10.1	Small/medium water feature	Low	Medium	Medium
WF2	Refer to Appendix A10.1	Small water feature	Low	Medium	Medium
WF4	Photograph 10.6	Drainage channel	Low	Low	Low
WF5	Refer to Appendix A10.1	Small water feature	Low	Medium	Medium
WF5A	Refer to Appendix A10.1	Drainage channel	Low	Low	Medium
WF7	Refer to Appendix A10.1	Drainage channel	High	Low	Medium
WF8 (Inchewan Burn)	Photograph 10.3	Medium water feature	High	High	Medium
WF9	Refer to Photograph 10.4	Small water feature	Very High	Medium	Medium
WF11 (River Braan)	Refer to Photograph 10.2	Medium/large WFD waterbody	Very High	Very High	Very High
WF11A	Refer to Appendix A10.1	Drainage channel	Low	Low	Medium
WF12 (Mill Stream)	Refer to Appendix A10.1	Small water feature (artificial)	Very High	Low	Medium
WF12A	Refer to Appendix A10.1	Drainage channel	Low	Medium	Medium
WF12B	Refer to Appendix A10.1	Drainage channel	Low	Low	Medium
WF13	Refer to Photograph 10.5	Small water feature	Very High	High	Medium
WF14	Refer to Appendix A10.1	Small water feature	Low	Medium	Medium
WF16	Refer to Appendix A10.1	Small water feature	Low	Medium	Medium
WF17	No photo (not accessed)	Drainage channel	Low	Low	Low
WF18	Refer to Appendix A10.1	Small water feature	Very High	Medium	Low
WF186	Refer to Appendix A10.1	Drainage channel	Low	Low	Low
WF187	Refer to Appendix A10.1	Drainage channel	Low	Low	Low

Future Baseline

10.3.13 The SEPA Water Environment Hub (SEPA, 2020c) provides target conditions for 2021 and 2027 for all baseline water bodies. Predicted overall condition of the River Tay (R Tummel to R Isla Confluences) and River Braan as stated on the SEPA Water Environment Hub (SEPA, 2020c) are summarised in Table 10.5 for baseline surface water bodies. Predictions for overall conditions consider assumptions of the future quality of various parameters including, but not limited to, fish access, water flows and levels, physical condition, freedom from invasive species and water quality. Yearly classification data for baseline surface water bodies is provided on the SEPA Water Classification Hub (SEPA, 2020b).

Table 10.5: WFD target conditions for water bodies within the study area (SEPA, 2020c).

Parameter	Receptor (WFD Water Body)	
	River Tay (R Tummel to R Isla Confluence) (WF06)	River Braan (WF11)
2014 Overall Condition	Moderate	Good
2021 Projected Overall Condition	Moderate	Good
2027 Projected Overall Condition	Good	Good
Long-term Projected Overall Condition	Good	Good

10.3.14 For the River Braan, there are no pressures noted that would prevent the water body from maintaining Good Overall Condition (or Status) in the future.

10.3.15 For the River Tay, barriers to fish migration are the main pressure preventing the achievement of Good Overall Condition (or Status). As such, the River Tay (R Tummel to R Isla Confluences) is designated as a Heavily Modified Water Body. Due to technical feasibility the deadline to remove the fish barriers has been extended to 2027. However, it is noted that the SEPA Water Environment Hub (SEPA, 2020c) states the Overall Condition as Moderate in 2014, however the SEPA Water Classification Hub (SEPA, 2020b) notes the Overall Status to be Moderate Ecological Potential for the 2013 and 2014 classification years, improving to Good Ecological Potential for the 2015, 2016, 2017 and 2018 classification years. It is therefore reasonable to assume that provided no significant additional pressures are noted on the River Tay (R Tummel to R Isla Confluences) or no significant changes are made to RBMP assessment criteria, it would maintain Good Ecological Potential in the future.

10.3.16 Generally, long-term projected conditions for all watercourses (including minor watercourses) may be influenced by increases in river flow and rainfall intensity as a result of climate change. Baseline flood modelling for the Jacobs refined flood model and simple assessment of culvert capacity on the minor watercourses includes a 20% peak river flow allowance. In a 'do-minimum' scenario whereby the proposed route options do not proceed, existing impacts on the hydromorphology and surface water quality of watercourses crossed by and receiving runoff from the existing A9, Highland Main Line railway, local roads and other land uses are anticipated to continue, however these impacts would likely be exacerbated by increases in river flows and rainfall intensity associated with climate change.

10.4 Potential Impacts and Effects

Introduction

10.4.1 This section describes the potential impacts and effects of the proposed route options on the surface water environment that could arise in the absence of mitigation. Potential mitigation measures are considered in Section 10.5 (Potential Mitigation) and would be developed further for the Preferred Route Option during the DMRB Stage 3 assessment.

10.4.2 Potential impacts and effects on the water environment are described separately for construction and operation. The types of potential impacts and effects are considered, followed by an assessment of potential impacts and effects common to all proposed route options and then an assessment of the potential impacts and effects that vary between the proposed route options. Potential effects with significance of Moderate and above only are presented within this chapter due to the number of water features potentially affected, with the exception of effects on Surface Water Quality during Operation (as described in paragraph 10.4.54 and paragraph 10.4.59). Potential effects of less than Moderate significance can typically be mitigated through application of standard good practice measures, explained further in Section 10.5 (Potential Mitigation).

10.4.3 As previously noted, where there are two alternatives provided in Table 10.3, a single significance rating has been chosen based on professional judgement, as per DMRB LA 104 and DMRB LA 113 guidance.

10.4.4 Due to the nature of some water features and/or distance from the proposed route options, it is considered that a number of features would not be affected or there is no potential to present a significant potential effect. The following water features, as identified on Figure 10.1 to 10.4, are therefore not considered further: Birnam Burn (WF1), WF4, WF186, WF187 and WF17.

Embedded mitigation

10.4.5 Embedded mitigation is defined within DMRB LA 104 as *"design measures which are integrated into a project for the purpose of minimising environmental effects".*

10.4.6 In line with DMRB LA 104, the significance of potential impacts is reported with embedded mitigation measures already considered.

10.4.7 Typical examples of embedded mitigation measures include:

- Designing culverts in accordance with appropriate design standards;
- Designing the mainline, junction, access roads and tracks to be above the 0.5% AEP (200-year) plus CC flood level;
- Including SuDS within the drainage design to provide treatment and attenuation of road runoff; and
- Incorporating pre-earthworks drainage (PED) to collect overland flow from the natural catchments and convey flow to the nearest watercourse.

10.4.8 Due to the level of detail available at this stage of the design, the only measures considered in the assessment are SuDS. However, specific types/combinations of SuDS are required to achieve appropriate discharge quality at each outfall location. Therefore, potential impacts and effects are reported without the inclusion of SuDS, with any significant effects that arise inclusive of SuDS reported in Section 10.6 (Summary of Route Options Assessment) with further detail on SuDS proposals for each route option provided in Section 10.5 (Potential Mitigation).

Proposed Activities

10.4.9 The number of anticipated in-channel construction works and operational structures associated with each of the four proposed route options for the scoped in water features are summarised in Table 10.6.

Table 10.6: Summary of Construction Works/Operational Structures

Construction works and Operational structures	Proposed Route Option			
	Option ST2A	Option ST2B	Option ST2C	Option ST2D
Number of bridges	3	3	3	3
Number of culvert extensions/replacements	11	11	11	11
Number of new culverts	1	1	0	0
Number of significant channel realignments/re-grading	2	2	1	1
Number of outfalls	10	9	9	8
Total number of in-channel works*	24	23	21	20
Number of water features requiring in-channel works *	14	14	14	14
Number of water features receiving new/upgraded road drainage runoff during operation	5	5	5	5

* Construction of outfalls, culverts and channel realignment/re-grading are classed as in-channel works

Construction

Potential Impacts

10.4.10 Potential construction impacts are identified in this section in terms of flood risk, hydromorphology, surface water quality and surface water supply. They are generally short-term, although in some cases can have longer term potential effects (e.g. on freshwater dependent habitats; refer to Volume 1, Part 3 - Environmental Assessment (Chapter 11: Biodiversity). For further details on constructability, refer to Volume 1, Part 2 - Engineering Assessment, Section 5.14 (Constructability).

Flood Risk

10.4.11 Potential construction impacts in relation to flood risk include, but are not limited to:

- Increased runoff from soil compaction due to works traffic, sedimentation, and disturbance/unintentional changes to channel dimensions, which may affect the hydraulic flow characteristics of a water feature.
- Increased flood risk from temporary channel diversions to facilitate culvert or bridge demolition/construction and any associated temporary or construction works or construction equipment/materials in the flood flow channel/route.
- Increased flood risk from channel diversions and re-direction through constructed realignments or into pre-earthwork ditches which may have a lower conveyance capacity. Conversely, larger pre-earthwork drainage ditches may pass flood risk downstream.
- Loss of floodplain area and volume from carriageway widening.

Hydromorphology

10.4.12 Potential construction impacts in relation to hydromorphology include, but are not limited to:

- Alterations to channel morphology during the demolition/construction of crossing structures, such as bridges or culverts, and associated channel modifications and the potential release of sediment.

- Sediment release during in-channel works, site clearance operations and earthworks in the vicinity of water features. This could result in reduced morphological diversity due to smothering of channel bed by sediment, an increase in turbidity and loss of active features such as gravel deposits.
- Disturbance of existing channel bed forms and morphological features as a result of in-channel working.
- Temporary removal of riparian habitat and floodplain connectivity due to construction activities and access.

Surface Water Quality

10.4.13 Potential construction impacts in relation to surface water quality, as a result of in-channel works or works in the vicinity of water features, include, but are not limited to:

- An increase in suspended sediment from demolition/construction of crossing structures, soil-stripping, compound preparation, soil storage and other earthworks due to loosening and erosion of sediment which could form silt-laden runoff and migrate to down gradient water features. This could also result in smothering of substrates and benthic ecology/habitats.
- A decline in downstream water quality resulting from tree felling activities resulting in turbid and nutrient rich runoff due to increase in soil erosion and the removal of riparian vegetation.
- An increase in alkalinity from spillages of concrete or cements.
- A downstream decline in water quality from accidental release of oils, fuels and chemicals from mobile or stationary plant.
- Inputs of contaminants from disturbance of potentially contaminated land with potential drainage pathways to water features.
- Sewage inputs from accidental/uncontrolled release from sewers through damage to pipelines during service diversion or unsatisfactory disposal of sewage from site welfare facilities.

Surface Water Supply

10.4.14 Potential construction impacts in relation to surface water supply include, but are not limited to:

- Pollution of a viable water resource through construction activities taking place upstream of a public or private water supply surface water abstraction.
- Severance of a public or private water supply due to disruption of pipelines and other buried assets present along the existing A9 corridor.

<u>Impacts and Effects Common to All Proposed Route Options (Construction)</u>

10.4.15 This section presents the potential significant effects (Moderate and above significance) that are common to all proposed route options for the construction phase. North of Inver (approximately ch5000) all proposed route options are identical.

Flood Risk

10.4.16 Generally, potential construction and operation flood risk impacts are similar, although the construction phase carries a slightly lower risk as potential impacts are temporary (albeit with potentially higher consequence or effect). However, a full understanding of the potential construction impacts would only develop with the detailed design and resulting construction methods. Table 10.7 summarises the potential for effects of Moderate or greater significance that are common to all proposed route options in relation to potential construction impacts on flood risk.

Table 10.7: Potential Impacts and Effects during Construction for Flood Risk

Water Feature ID (water body name)	Construction Activities	Importance	Impact Magnitude	Significance of Effect
River Tay (WF6)	▪ Birnam Junction requires some embankment works in the floodplain for the sewerage works access road. Loss of floodplain storage could potentially increase flood risk upstream in Dunkeld as a result of reduced conveyance of flood flows as well as changes to flow dynamics. ▪ Construction works associated with a SuDS basin in the floodplain to the east of the existing A9 at ch7100 would result in a temporary loss of floodplain. Floodplain is narrow in this area due to the valley topography; therefore, the works could constrict flood flows locally.	very high	moderate	**Very Large**
WF9	▪ Construction works in the floodplain and culvert extension/replacement would require a temporary diversion of the watercourse for the duration of the works. This could increase flood risk in areas that would not be considered to be at risk in the baseline situation.	very high	major	**Very Large**
River Braan (WF11)	▪ Loss of floodplain due to road widening and associated earthworks impacting on the River Braan (WF11) and a small section of the River Tay (WF6). ▪ New crossing of the A9 over the River Braan would replace the existing structure. However, during construction the existing structure would remain, while additional area of floodplain would be given over to the construction footprint. ▪ Construction works associated with a SuDS basin to the south of the existing A9 at ch4900 would also result in a temporary loss of the River Braan floodplain.	very high	major	**Very Large**
WF12	▪ Loss of floodplain and cause flow restriction due to the A9 culvert extension/replacement and in-channel works.	very high	moderate	**Very Large**
WF13	▪ Construction works in the floodplain and culvert extension/replacement would require a temporary diversion of the watercourse for the duration of the works. This could increase flood risk in areas that would not be considered to be at risk in the baseline situation.	very high	major	**Very Large**
WF18	▪ Loss of floodplain and cause flow restriction due to the A9 culvert extension/replacement and in-channel works.	very high	moderate	**Very Large**

Hydromorphology

10.4.17 With the exception of the Inchewan Burn (WF8), all proposed route options are considered to have similar potential impacts and effects on the water features during construction. Of these, four water features are considered to have potential effects of Moderate or greater significance, the River Tay (WF6), WF9 (crosses the proposed route options at approximately ch4100), WF13 (crosses the proposed route options at ch6900) and WF14 (crosses the realigned B898 at approximately ch7400). Table 10.8 summarises the potential for effects of Moderate or greater significance that are common to all proposed route options in relation to potential construction impacts on hydromorphology.

Table 10.8: Potential Impacts and Effects during Construction for Hydromorphology

Water Feature ID (water body name)	Construction Activities	Importance	Impact Magnitude	Significance of Effect
River Tay (WF6)	▪ New bridge structure to carry the A9 southbound carriageway over the River Tay (WF6) (approximately ch7500) ▪ Installation of four new road drainage outfalls for Options ST2B, ST2C and ST2D, and five new road drainage outfalls for Option ST2A. ▪ Major earthworks within 35m of bank south of Birnam Junction for Options ST2A, ST2B (approximately ch1800) and Options ST2C and ST2D (approximately ch1850). Embankment works within 5m of river at the confluence of Mill Stream (WF12) and the River Tay (approximately ch5020). ▪ The above works could potentially cause disturbance to the banks, altering morphological features and releasing fine sediment. Removal of the riparian zone during construction may alter the lateral connectivity of the water feature.	high	major	**Very Large**
WF9	▪ Construction of new elongated roundabout junction at Dunkeld for Options ST2A, ST2B and ST2D and a new grade separated junction at Dunkeld for Option ST2C are likely to require the replacement or extension of two culverts, an increase in culvert length and associated channel realignment where necessary. ▪ The above works could alter the channel morphology and significantly increase fine sediment delivery to the water feature.	medium	major	**Large**
WF13	▪ All proposed route options would require an extension/replacement of the existing A9 culvert with a new culvert to accommodate the works at Dalguise Junction, with associated channel realignment. ▪ The above works would require construction in the channel, potentially removing a large	high	major	**Very Large**

Water Feature ID (water body name)	Construction Activities	Importance	Impact Magnitude	Significance of Effect
	extent of both the bed and banks, altering morphological features and releasing fine sediment. The removal of the riparian zone during construction may alter the lateral connectivity, and the potential requirement to create a dry working area for in-channel works could further disrupt the flow and sediment regimes.			

Surface Water Quality

10.4.18 Table 10.9 summarises the potential effects of Moderate significance or greater that are common to all proposed route options in relation to potential construction impacts on water quality. The types/extent of construction activities and in-channel works could lead to varying degrees of siltation, polluted runoff and spillages entering water features. The potential impact magnitude for construction was determined by the type, as well as the number of construction activities and in-channel works (refer to Table 10.2) as these activities can result in pollution of the water environment. The importance of the receiving water feature is then considered to determine the potential for a significant effect.

Table 10.9: Potential Impacts and Effects during Construction for Surface Water Quality

Water Feature ID (water body name)	Construction Activities	Importance	Impact Magnitude	Significance of Effect
WF6 (River Tay)	▪ Construction of new structure to carry the A9 southbound carriageway (existing Tay Crossing would carry the A9 northbound carriageway). ▪ Installation of 4 - 5 road drainage outfalls. ▪ Major earthworks in vicinity of water feature (including within 35m of the river bank south of Birnam Junction (approximately ch1850) and 5m at ch5020). ▪ Cumulative sediment/pollutant inputs from works on tributaries.	very high	major	**Very Large**
WF9	▪ Extension/replacement of two culverts with associated channel realignments where necessary.	medium	major	**Large**
WF11 (River Braan)	▪ Demolition of existing A9 bridge structure and construction of new crossing structure. ▪ Installation of one new road drainage outfall.	very high	moderate	**Large***
WF13	▪ Construction/extension/replacement of two culverts with associated channel realignments.	medium	major	**Large**

*Lower significance chosen (following DMRB LA 104 guidance) based on professional judgement as the main channel is approximately 13.8km in length, with impacts and effects isolated to a 300m reach immediately upstream of the confluence with the River Tay.

Surface Water Supply

10.4.19 All proposed route options are considered to have similar potential impacts on the agricultural supply associated with the River Tay during construction. Potential impacts to surface water quality in the River Tay during construction (described in Table 10.9) may subsequently result in a partial change to surface water supply with a potential effect of moderate magnitude resulting in an effect of Large Significance.

Impacts and Effects Specific to Option ST2A (Construction)

10.4.20 This section presents the potential effects of Moderate or greater significance that are specific to Option ST2A for the construction phase and which are additional to those reported as common to all proposed route options. The estimated construction duration for Option ST2A is approximately 4.5 to 5 years.

10.4.21 Option ST2A requires extensive works on Inchewan Burn (WF8) (Illustration 10.1). Works include the demolition of the existing A9 bridge crossing (Birnam Glen Underbridge), vertical realignment of the watercourse, construction of a drop structure and new box culvert, a new side road bridge structure (for access to properties at Birnam Glen) and installation of two road drainage outfalls. Vertical realignment of approximately 8m is required to accommodate the proposed cut and cover tunnel (extending approximately 1.5km from ch2150 to ch3070). Due to the existing Highland Main Line railway bridge, a vertical drop structure is required to achieve the realignment. The watercourse would then enter a box culvert, which would extend approximately 55m under the proposed tunnel. Further downstream, channel regrading would be required for approximately a further 120m to tie in with the existing downstream channel. It is anticipated that these works would take approximately 12-18 months.

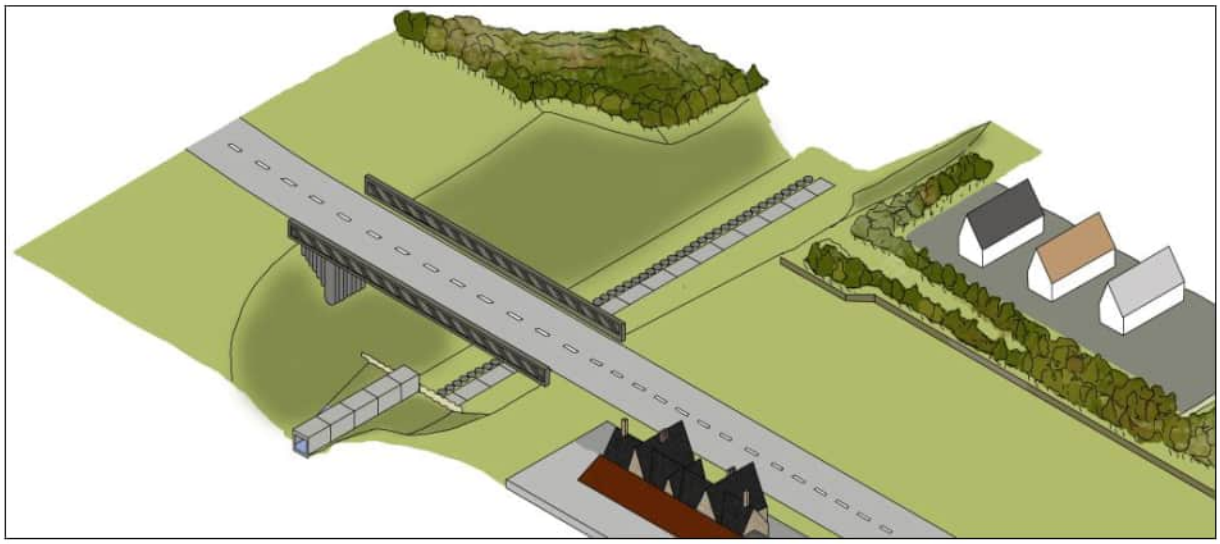

Illustration 10.1: Inchewan Burn culvert construction with temporary A9 alignment, permanent drop structure and culvert prior to construction of tunnel.

Flood Risk

10.4.22 The proposed vertical realignment and new crossing upstream of Dunkeld & Birnam Station on Inchewan Burn (WF8) would require extensive in channel works potentially limiting the channel capacity during construction, resulting in increased flood risk to construction activities. Additionally, as the vertical realignment is extensive, this coupled with the length of the tunnel encroaching on WF8, would require the watercourse to be temporarily diverted via a culvert around the works to allow construction of the inlet, drop structure, culvert and downstream watercourse realignment. Diverted watercourses carry a higher risk of flooding as they tend to lack the opportunities for storage of flood flows provided by the floodplain in the (pre-diversion) scenario. Therefore, high magnitude flows are more likely to cause

flooding with a potential impact of major magnitude resulting in the potential for an effect of Very Large significance.

10.4.23 The proposed construction works on and around WF7 would likely require a temporary diversion of the culverted watercourse for the duration of the works as the existing culvert is anticipated to intercept the working area of the proposed tunnel. Temporary diversions can increase flood risk in areas that would not be considered to be at risk in the baseline situation; therefore, the potential impact is considered to be of major magnitude resulting in the potential for an effect of Very Large significance.

Hydromorphology

10.4.24 Construction works on the Inchewan Burn (WF8) would involve extensive construction in the channel and would lead to the total loss of the restored reach of Inchewan Burn, extending a significant distance downstream towards Perth Road, including removal of sections of the riparian zone, as well as changes to channel morphology and increased delivery of fine sediment to the downstream reach of the watercourse. This is considered to have a potential impact of major magnitude resulting in the potential for an effect of Very Large significance. Further details of the engineering proposals and potential impacts and effects on Inchewan Burn for Option ST2A are detailed in *Appendix A10.2: Inchewan Burn.*

10.4.25 The existing bridge over the River Braan (WF11) would be demolished and a new structure would be constructed (approximately ch4320). Additional works would include installation of one new road drainage outfall and earthworks in the vicinity of the water feature, particularly on the western side of the new bridge crossing. In-channel works would potentially require the bed and banks to be disturbed, altering morphological features and releasing fine sediment. The modification of approximately 60m of the riparian zone (though structures and bank modification are currently present) during construction may also alter the lateral connectivity of the water feature and the potential requirement to create a dry working area for in-channel works, which could further disrupt the flow and sediment regimes. This is considered to have a potential impact of moderate magnitude resulting in the potential for an effect of Large significance. The lower significance has been chosen (following DMRB LA 104 guidance) based on professional judgement as effects are restricted to a relatively short (60m) reach of the watercourse.

Surface Water Quality

10.4.26 Construction works on Inchewan Burn (WF8) would require extensive in-channel works over an extended reach of the watercourse over a long duration (12-18 months). This could lead to increased siltation and polluted runoff and spillages, potentially affecting water quality and associated aquatic ecology, particularly in the restored reach (RRC, 2013) (which would be removed) in the vicinity of the existing A9 crossing and downstream towards Perth Road. The vertical realignment of Inchewan Burn would also prevent fish passage in this reach. Disturbance to, or disruption of the drainage network and treatment mechanisms associated with Ladywell Landfill to facilitate construction of the new side road to properties at Birnam Glen, could also lead to pollutants entering Inchewan Burn. Overall, these works are considered to have a potential impact of major magnitude resulting in the potential for an effect of Large significance on Inchewan Burn.

Surface Water Supply

10.4.27 There are anticipated to be no specific impacts or effects in addition to those reported as common to all proposed route options.

<u>Impacts and Effects Specific to Option ST2B (Construction)</u>

10.4.28 This section presents the potential effects of Moderate or greater significance that are specific to Option ST2B for the construction phase and which are additional to those reported as common to all proposed route options.

10.4.29 The estimated construction duration for Option ST2B is approximately 4-4.5 years.

10.4.30 Option ST2B requires extensive works on Inchewan Burn (WF8). Works include the demolition of the existing A9 bridge crossing (Birnam Glen Underbridge), vertical realignment of the watercourse, construction of a drop structure and new box culvert, a new side road bridge structure (for access to properties at Birnam Glen) and installation of two road drainage outfalls. Vertical realignment of Inchewan Burn (WF8) of approximately 6m is required to accommodate the proposed 150m underpass structure in the vicinity of Dunkeld & Birnam Station (ch2900 to ch3900). The watercourse would then enter a box culvert, which would extend approximately 35m under the proposed underpass. Further downstream, channel regrading would be required for a further 35m (approximately) to tie in with the existing downstream channel. Further details of the engineering proposals on Inchewan Burn for Option ST2B are provided in *Appendix A10.2: Inchewan Burn.* It is anticipated that these works would take approximately 12-18 months.

Flood Risk

10.4.31 The proposed vertical realignment and new crossing upstream of Dunkeld & Birnam Station on Inchewan Burn (WF8) would require extensive in channel works potentially limiting the channel capacity during construction, resulting in increased flood risk to construction activities. Additionally, as the vertical realignment is extensive, this coupled with the length of the underpass encroaching on Inchewan Burn, the watercourse would need to be diverted around works during construction to allow construction of the inlet, drop structure, culvert and downstream watercourse realignment. Diverted watercourses carry a higher risk of flooding as they tend to lack the opportunities for storage of flood flows provided by the floodplain in the pre diversion scenario. Therefore, high magnitude flows are more likely to cause flooding. These works are considered to have a potential impact of major magnitude resulting in the potential for an effect of Very Large significance.

Hydromorphology

10.4.32 The potential impacts on Inchewan Burn (WF8) for hydromorphology are considered to be the same as those reported for Option ST2A. This is considered to have a potential impact of major magnitude resulting in the potential for an effect of Very Large significance.

10.4.33 The potential impacts on the River Braan (WF11) for hydromorphology are considered to be the same as to those associated with Option ST2A with a potential impact of moderate magnitude resulting in the potential for an effect of Large significance.

Surface Water Quality

10.4.34 The potential impacts on water quality for Inchewan Burn (WF8) are considered to be the same as those associated with Option ST2A, with a potential impact of major magnitude resulting in the potential for an effect of Large significance.

Surface Water Supply

10.4.35 There are anticipated to be no specific impacts or effects in addition to those reported as common to all proposed route options.

Impacts and Effects Specific to Option ST2C (Construction)

10.4.36 This section presents the potential effects of Moderate or greater significance that are specific to Option ST2C for the construction phase and which are additional to those reported as common to all proposed route options.

10.4.37 The estimated construction duration for Option ST2C is approximately 2.5 to 3 years.

Flood Risk

10.4.38 Construction activities north of the River Braan (WF11) would require some extensive embankment works in the River Tay (WF6) floodplain at ch4400, potentially increasing flood risk due to loss of floodplain storage. This is considered to have a potential impact of major magnitude resulting in the potential for an effect of Very Large significance.

Hydromorphology

10.4.39 Construction works on the Inchewan Burn (WF8) would include demolition of the existing A9 structure and construction of a new bridge structure and installation of two road drainage outfalls. This could potentially lead to removal of a portion of the riparian zone between the existing A9 bridge crossing and the Highland Main Line railway; and also, a short reach downstream of the new bridge structure. This is in addition to changes to channel morphology from increased sediment delivery. This is considered to have a potential impact of moderate magnitude resulting in the potential for an effect of Large significance.

10.4.40 The existing bridge over the River Braan (WF11) would require similar construction works to Option ST2A, however more extensive modification of the riparian zone would be required. This would include alterations to approximately 140m of the banks during construction, altering the lateral connectivity of the water feature. In addition, there is a potential requirement to create a dry working area for in-channel works, which could further disrupt the flow and sediment regimes. Due to the greater extent of modification, this is considered to have a potential impact of moderate magnitude resulting in the potential for an effect of Very Large significance on the River Braan. The higher significance of effect has been selected (following DMRB LA 104 guidance) based on professional judgement as effects are to a relatively long (140m) reach of the watercourse and a substantial area of the riparian zone.

Surface Water Quality

10.4.41 The A9 carriageway northbound widening associated with Option ST2C would require the demolition of the existing A9 structure and construction of a new bridge structure, associated earthworks and construction of two road drainage outfalls on Inchewan Burn (WF8). This could lead to increased siltation and polluted runoff and spillages, potentially affecting water quality and associated aquatic ecology, particularly in the restored reach (RRC, 2013) in the vicinity of the existing A9 crossing and downstream. This is considered to have a potential impact of moderate magnitude resulting in the potential for an effect of Moderate significance on Inchewan Burn.

Surface Water Supply

10.4.42 There are anticipated to be no specific impacts or effects in addition to those reported as common to all proposed route options.

<u>Impacts and Effects Specific to Option ST2D (Construction)</u>

10.4.43 This section presents the potential effects of Moderate or greater significance that are specific to Option ST2D for the construction phase and which are additional to those reported as common to all proposed route options.

10.4.44 The estimated construction duration for Option ST2D is approximately 2.5 to 3 years.

Flood Risk

10.4.45 There are anticipated to be no specific impacts or effects in addition to those reported as common to all proposed route options.

Hydromorphology

10.4.46 The potential impacts on Inchewan Burn (WF8) for hydromorphology are considered to be similar to those reported for Option ST2C (refer to paragraph 10.4.39), however only one road drainage outfall is proposed. This is considered to have a potential impact of moderate magnitude resulting in the potential for an effect of Large significance.

10.4.47 The potential impacts on the River Braan (WF11) for hydromorphology are considered to be the same as those associated with Option ST2A (refer to paragraph 10.4.25), with a potential impact of moderate magnitude resulting in the potential for an effect of Large significance.

Surface Water Quality

10.4.48 The potential impacts on Inchewan Burn (WF8) for water quality (requiring the widening of the northbound carriageway, construction of a new bridge and associated earthworks as well as one road drainage outfall) are considered to be the same as those reported for Option ST2C (refer to paragraph 10.4.41). This is considered to have a potential impact of moderate magnitude resulting in the potential for an effect of Moderate significance on Inchewan Burn.

Surface Water Supply

10.4.49 There are anticipated to be no specific impacts or effects in addition to those reported as common to all proposed route options.

Operation

Potential Impacts

Flood Risk

10.4.50 Potential operational impacts on flood risk include, but are not limited to:

- Introduction of new impermeable areas within surface water catchments which could potentially increase the volume and peak flow of surface runoff reaching water features caused by a reduction in infiltration capacity. The road and its drainage system may also act as a barrier to water movement within existing catchments.
- Potential flow regime modifications from flows in one catchment being discharged to another via the road drainage system.
- Alteration of the physical flow and water level regimes from the introduction or alteration of channel crossings.
- Channel realignments could potentially change the discharge regime of water features. However, with appropriate design in terms of hydraulic considerations, these realignments would not affect surface water hydrology unless the realignment significantly changes the catchment of the water feature.
- Where necessary, the inclusion of pumps to effectively drain the low points on the vertical alignment carry a residual risk of flooding in the event of failure or drain blockage.

Hydromorphology

10.4.51 Potential operational impacts on hydromorphology include, but are not limited to:

- Increased flow and sediment discharges from new drainage outfalls, in addition to alteration of river banks for new outfall structures, can potentially alter local sediment flow and dynamics leading to downstream erosion and/or deposition.
- Crossings (including culverts) and associated piers, abutments and embankments causing the loss of morphological features upstream and downstream, and continuity of processes disrupted by structures (including culverts) and potential for increased flow velocities causing downstream erosion.
- Potential changes in channel length, gradient, discharge, and flow velocity due to channel realignment/re-grading, which could cause alterations to the baseline flow and sediment regime. However, realignments could also offer an opportunity to locally restore water features with low morphological diversity.

Surface Water Quality

10.4.52 Potential operational impacts in relation to water quality include, but are not limited to:

- increases in the volume and/or frequency of contaminated road runoff entering downstream water features;
- changes in the sediment regime resulting in increased erosion or deposition rates from culverts and channel realignments which could mobilise suspended solids and release previously 'locked' contaminants; and
- changes in flow type (e.g. from turbulent to laminar), turbulence and decreases in light, from new, extended or replacement culverts and channel realignments. These effects could also restrict aquatic plant photosynthesis, and cause changes in dissolved oxygen levels.

Surface Water Supply

10.4.53 Potential operational impacts in relation to surface water supply include a permanent loss of a public or private water supply due to disruption of pipelines and other buried assets present along the existing A9 corridor.

Impacts and Effects Common to All Proposed Route Options (Operation)

10.4.54 This section presents the potential effects of Moderate or greater significance that are common to all proposed route options during the operational phase for flood risk and hydromorphology. North of Inver, the design of the proposed route options is common to all. As DMRB LA 113 requires an assessment of the proposed operational drainage design using HEWRAT, all potential effects associated with this assessment, including those lower than Moderate significance are reported in this section for surface water quality.

Flood Risk

10.4.55 Although potential construction and operational flood risk impacts are similar, the operational phase carries a slightly lower consequence with only the permanent elements remaining in the floodplain which present a lesser footprint than during the construction phase. Despite this, due to the permanency of the structures during operation, the overall risk is higher compared to the construction phase.

10.4.56 Table 10.10 summarises the potential for effects of Moderate or greater significance that are common to all proposed route options in relation to potential construction impacts on flood risk.

Table 10.10: Potential Impacts and Effects during Operation for Flood Risk

Water Feature ID (water body name)	Operational Impacts	Importance	Impact Magnitude	Significance of Effect
WF9	▪ Increase in headwater level (which is out of bank and higher than the existing A9 road level in the baseline scenario) during the 0.5% AEP (200-year) plus CC event of >100mm due to the increased culvert length.	very high	major	**Very Large**
WF12	▪ Loss of floodplain and cause flow restriction due to the A9 culvert extension/ replacement.	very high	moderate	**Very Large**
WF13	▪ Increase in headwater level (which is out of bank and higher than the existing A9 road level in the baseline scenario) during the 0.5% AEP (200-year) plus CC event of >100mm due to the increased culvert length.	very high	major	**Very Large**

Hydromorphology

10.4.57 With the exception of two water features (Inchewan Burn (WF8) and the River Braan (WF11), all proposed route options are considered to have similar potential impacts on the water features during operation. Of these, four water features, the River Tay (WF6), WF9 (crosses the proposed route options at approximately ch4100), WF13 (crosses the proposed route options at ch6900) and WF14 (crosses the realigned B898 at approximately ch7400), are considered to have potential effects of Moderate or greater significance. The magnitude of potential impacts and the potential for significant effects on these water features are considered to be similar to those effects reported during construction (Table 10.8). Table 10.11 summarises the potential for effects of Moderate significance or greater that are common to all proposed route options during operation on hydromorphology.

Table 10.11: Potential Impacts and Effects during Operation for Hydromorphology

Water Feature ID (water body name)	Operational Impacts	Importance	Impact Magnitude	Significance of Effect
River Tay (WF6)	▪ New bridge structure carrying the A9 southbound carriageway over the River Tay (WF6) and installation of four to five new road drainage outfalls would potentially require additional abutments, embankments and piers which would permanently remove a section of the river bank/riparian zone. ▪ The above structures would have the potential to locally change the channel cross-section, alter hydraulics and potentially cause siltation of the channel over the long-term; however, the potential impacts and effects are likely to be localised to the change in channel geometry.	high	major	**Very Large**

Water Feature ID (water body name)	Operational Impacts	Importance	Impact Magnitude	Significance of Effect
	▪ The embankments for all proposed route options encroach into the floodplain at Birnam Junction (approximately ch1800-1900), Inver (ch4300-5020) and Inverwood (ch6900), which would impact on lateral connectivity and potentially impact on local hydraulics during high flows.			
River Tay (WF6)	▪ New bridge structure carrying the A9 southbound carriageway over the River Tay (WF6) and installation of four to five new road drainage outfalls would potentially require additional abutments, embankments and piers which would permanently remove a section of the river bank/riparian zone. ▪ The above structures would have the potential to locally change the channel cross-section, alter hydraulics and potentially cause siltation of the channel over the long-term; however, the potential impacts and effects are likely to be localised to the change in channel geometry. ▪ The embankments for all proposed route options encroach into the floodplain at Birnam Junction (approximately ch1800-1900), Inver (ch4300-5020) and Inverwood (ch6900), which would impact on lateral connectivity and potentially impact on local hydraulics during high flows.	high	major	**Very Large**
WF9	▪ Extended/replacement culverts and permanent channel realignments could remove a portion of the riparian zone, cause changes in the flow and sediment regimes, and potentially cause localised areas of erosion around the structures.	low	major	**Large**
WF13	▪ Extended/replacement culverts and channel realignments have the potential to cause localised changes in flow velocities and flow patterns resulting in long-term alterations to the lateral connectivity and changes to the hydraulic roughness of the channel. ▪ Potential for downstream processes to be altered, including bed and bank stability and patterns of erosion and sedimentation.	high	major	**Very Large**

Surface Water Quality

10.4.58 The following 'common to all' potential impacts relate specifically to the operation of new road drainage outfalls. As noted in Section 10.2 (Approach and Methods), there are variances in the operational drainage design between the proposed route options, however the results of the HEWRAT calculations have concluded that potential effects on the receiving watercourses are 'common to all'. Table 10.12

summarises the potential impacts and effects that are common to all proposed route options during operation on water quality.

10.4.59 As DMRB LA 113 requires an assessment of the proposed operational drainage design using HEWRAT, all potential effects associated with this assessment, including those lower than Moderate significance are reported in this section for surface water quality.

Table 10.12: Potential Impacts and Effects during Operation for Surface Water Quality

Water Feature ID (water body name)	Operational Impacts	Importance	Impact Magnitude	Significance of Effect
River Tay (WF6)	▪ All proposed route options require outfalls to the River Tay (five for Option ST2A and four for Options ST2B, ST2C and ST2D) ▪ HEWRAT calculations result in a 'Pass' at Step 2 Tier 1 (i.e. after mixing but prior to any SuDS mitigation in place). Soluble pollutants are well within the published thresholds.	very high	negligible	Slight
River Braan (WF11)	▪ All proposed route options require outfalls to the River Braan (one outfall for all proposed route options). ▪ HEWRAT calculations result in a 'Pass' at Step 2 Tier 1 (i.e. after mixing but prior to any SuDS mitigation in place). Soluble pollutants are well within the published thresholds.	very high	negligible	Slight
Inchewan Burn (WF8)	▪ All proposed route options require outfalls to Inchewan Burn (two for Options ST2A, ST2B and ST2C and one for Option ST2D). ▪ HEWRAT calculations result in a 'Pass' at Step 2 Tier 2 (i.e. after mixing but prior to any SuDS mitigation in place and more detailed assessment accounting for channel dimensions). Soluble pollutants are well within the published thresholds.	medium	negligible	Neutral
Mill Stream (WF12)	▪ All proposed route options require outfalls to Mill Stream (WF12) (one outfall for all proposed route options). ▪ HEWRAT calculations result in a 'Fail' at Step 2 Tier 1 (i.e. after mixing but prior to any SuDS mitigation in place). This includes a failure of EQS, soluble and sediment-bound pollutants.	medium	major	**Large**
WF12A	▪ All proposed route options require outfalls to WF12A (one outfall for all proposed route options). ▪ HEWRAT calculations result in a 'Fail' at Step 2 Tier 1 (i.e. after mixing but prior to any SuDS mitigation in place). This includes a failure of EQS, soluble and sediment-bound pollutants.	medium	major	**Large**

10.4.60 HEWRAT calculates the dilution potential of pollutants based on the watercourse flow rate under low flow conditions. This is when exceedances of the ecological thresholds are most likely; the low flow value used is the Q_{95}, and also takes into account the river velocity to estimate whether sediment is likely to accumulate. For the Mill Stream (WF12) and WF12A, the Q_{95} values were calculated as 0.004m^3/s and 0.001m^3/s respectively, which indicates that there is limited dilution potential available. These water features have been characterised as having medium importance based on the importance criteria outlined in Table 10.1 due to their Q_{95} values, this results in a potential impact of major magnitude resulting in the potential for an effect of Large significance. However, from the inspections on-site of the two watercourses, Mill Stream is known to be characterised by low flow/stagnant water and is an artificial watercourse likely to be controlled by the flow of the River Braan. In addition, it is noted in Volume 1, Part 3 – Environmental Assessment (Chapter 11: Biodiversity) that WF12 as has no suitable habitat for protected species and is not accessible for migratory salmonids, WF12A was also characterised by low flow and as-built drawings of the existing A9 show that it currently receives untreated runoff from the existing single carriageway. In addition, it is culverted from the proposed outfall location for most of its length prior to discharging into the River Tay (WF6).

10.4.61 SuDS mitigation to treat/attenuate road runoff prior to outfalling to water features is discussed in Section 10.5 (Potential Mitigation). Further HEWRAT assessment would be undertaken at DMRB Stage 3, including reporting of concentrations for each outfall, and consideration of any accidental spillage risk on receiving water features, following DMRB LA 113 procedures.

Surface Water Supply

10.4.62 None of the proposed route options are considered to have significant potential effects on the agricultural supply associated with the River Tay during operation. The agricultural supply is located approximately 90m from the operational carriageway on the opposite side of the River Tay and therefore it is considered unlikely the supply pipeline would be disrupted.

Impacts and Effects Specific to Option ST2A (Operation)

10.4.63 This section presents the potential for effects of Moderate or greater significance that are specific to Option ST2A for the operational phase, and which are additional to those reported as common to all proposed route options.

Flood Risk

10.4.64 The vertical alignment of the proposed tunnel at (ch3270 to ch3410) results in a number of low points that would require drainage by a gravity fed system with a pumping station provided as back-up to provide additional capacity during exceedance events. Pumping stations would be designed with capacity to pump during a flood event. However, although the likelihood is low, there remains a risk that there would potentially be pump failure or blockage. The potential impact is assessed to be of major magnitude resulting in the potential for an effect of Large significance. Additional mitigation would be required to further mitigate this effect.

10.4.65 The proposed works at Inchewan Burn (WF8) include a drop structure and culvert necessary to convey the watercourse beneath the proposed tunnel. The risk of debris blockage and siltation of the drop structure and culvert has the potential to result in an increased flood risk of moderate magnitude resulting in the potential for an effect of Large significance.

10.4.66 The new crossing of the A9 over the River Braan (WF11) would remove an existing flow restriction, due to the replacement of the existing structure. The loss of floodplain on the River Braan may result in an adverse impact; however, the new crossing structure is likely to offer a beneficial impact and reduce the flood risk to the proposed A9 between ch4300 and ch4700. The removal of the flow restriction at the River Braan crossing would improve the conveyance of flood flows and result in a reduction in flood

levels upstream of the River Braan of between 250mm and 350mm. This is considered to have a potential impact of major beneficial magnitude resulting in the potential for an effect of Very Large significance on the River Braan (WF11) and major beneficial magnitude resulting in an effect of Large significance on Mill Stream (WF12). However, it is noted that the areas upstream of the River Braan (WF11) crossing, which are at risk of flooding in the baseline situation, would remain at significant risk of flooding (potential for an effect of Very Large significance) despite these beneficial impacts.

10.4.67 In addition, there is a reduction in flood levels on the River Tay (WF6) of 10-25mm, resulting in a potential impact of minor beneficial magnitude resulting in the potential for an effect of Moderate beneficial significance. However, it is also noted that the areas which are at risk of flooding in the baseline situation would remain at significant risk (potential for an effect of Very Large significance) despite these beneficial impacts.

Hydromorphology

10.4.68 The new A9 culvert structure (including drop structure) conveying Inchewan Burn (WF8) and the operation of two road drainage outfalls would affect flow and sediment regimes and would permanently remove a portion of the riparian zone and alter the stability of the watercourse during high flows. The new side road bridge (to properties at Birnam Glen) would also permanently remove a portion of the riparian zone. These potential impacts and effects are considered to contravene the objectives of RBMP and the WEWS Act. It is anticipated that the lowering of the vertical realignment of Inchewan Burn by approximately 8m would cause significant changes in flow processes and morphological behaviour within the culverted 55m reach and the downstream vertical realignment (approximately 120m). This would result in permanent alterations to lateral and longitudinal connectivity upstream and downstream of the A9. Changes to bed and bank stability and permanent changes to patterns of erosion, deposition and natural transport of sediment from the upstream to the downstream reaches of watercourse would also occur. The watercourse modification is likely to extend a substantial distance downstream to enable vertical realignment of the stream bed. This is considered to result in a permanent potential impact of major magnitude resulting in the potential for an effect of Very Large significance on the water feature.

10.4.69 The new bridge structure over the River Braan (WF11) (approximately ch4320), including embankments within 10m of the banks, and the operation of one road drainage outfall could potentially alter local sediment and flow dynamics of the river. This is considered to have a potential impact of moderate magnitude resulting in the potential for an effect of Large significance on the River Braan.

Surface Water Quality

10.4.70 The vertical realignment of Inchewan Burn and introduction of a drop structure would permanently remove fish passage from the reach downstream of the A9 to the reach upstream of the A9. This impact is considered to contravene the objectives of RBMP and the WEWS Act. This is determined to have a potential impact of major magnitude resulting in the potential for an effect of Large significance.

Surface Water Supply

10.4.71 There are anticipated to be no specific impacts or effects in addition to those reported as common to all proposed route options.

<u>Impacts and Effects Specific to Option ST2B (Operation)</u>

10.4.72 This section presents the potential for effects of Moderate or greater significance that are specific to Option ST2B for the operational phase, and which are additional to those reported as common to all.

Flood Risk

10.4.73 The simplified assessment of the crossing of WF5A results in an increase in headwater level (which is out of bank in the baseline scenario) during the 0.5% AEP (200-year) plus CC event of >100mm. This is due to the increased culvert length and is considered to be of major magnitude resulting in the potential for an effect of Moderate significance.

10.4.74 The vertical alignment of the proposed underpass of the dualling in the vicinity of Dunkeld & Birnam Station results in a low point at its northern extent that would drain via a gravity fed system with a pumping station provided to operate during exceedance events as a back-up system. Pumping stations would be designed with capacity to pump during a flood event, however, although the likelihood is low, there remains a risk that there would potentially be pump failure or blockage. The potential impact is assessed to be of major magnitude resulting in an effect of Large significance. Additional mitigation would be required to further mitigate this effect.

10.4.75 The proposed works at Inchewan Burn (WF8) include a drop structure and culvert necessary to convey the watercourse beneath the proposed tunnel. The risk of debris blockage and siltation of the drop structure and culver has to potential to result in an increased flood risk of moderate magnitude resulting in the potential of effect of Large significance.

10.4.76 The potential impacts on the River Braan (WF11) and River Tay (WF6) are considered to be similar as for Option ST2A with a potential impact of major beneficial magnitude resulting in the potential for an effect of Very Large beneficial significance on the River Braan (WF11), major beneficial magnitude resulting in the potential for an effect of Large beneficial significance on Mill Stream (WF12A) and minor beneficial magnitude and potential for an effect of Moderate beneficial significance on the River Tay (WF6). However, it is noted that the areas upstream of the River Braan (WF11) crossing, in the area of Mill Stream (WF12) and along the River Tay (WF6) which are at risk of flooding in the baseline situation would remain at significant risk (potential effect of Very Large significance) despite these beneficial impacts.

Hydromorphology

10.4.77 The potential impacts and effects on hydromorphology are considered to be the same as those for Option ST2A.

Surface Water Quality

10.4.78 The potential impacts and effects on water quality are to be considered to be the same as those for Option ST2A.

Surface Water Supply

10.4.79 There are anticipated to be no specific impacts or effects in addition to those reported as common to all proposed route options.

<u>Impacts and Effects Specific to Option ST2C (Operation)</u>

10.4.80 This section presents the potential for effects of Moderate or greater significance that are specific to Option ST2C for the operational phase, and which are additional to those reported as common to all.

Flood Risk

10.4.81 The potential impacts and effects on the crossing of WF5A are anticipated to be the same as those for Option ST2B (refer to paragraph 10.4.73). This is considered to be a potential impact of major magnitude resulting in the potential for an effect of Moderate significance.

10.4.82 The potential impacts on the River Braan (WF11) are considered to be the same as those for Option ST2A (refer to paragraph 10.4.66) with a potential impact of major beneficial magnitude resulting in the potential for an effect of Very Large beneficial significance on the River Braan (WF11) and, major beneficial magnitude resulting in the potential for an effect of Large beneficial significance on Mill Stream (WF12). However, it is noted that the areas upstream of the River Braan (WF11) crossing and in the area of Mill Stream (WF12) that are at risk of flooding in the baseline situation would remain at significant risk (potential for effect of Very Large significance) despite these beneficial impacts. The extensive embankments in the River Tay (WF6) floodplain at ch4400 would potentially increase flood risk on the left and right bank of the River Tay due to loss of floodplain storage and reduced floodplain conveyance (with a resultant flood level increase of up to 20mm). This is considered to have a potential impact of minor magnitude resulting in the potential for an effect of Large significance on the River Tay (WF6).

Hydromorphology

10.4.83 The new A9 bridge structure on Inchewan Burn (WF8) would remove a portion of the riparian zone, between the existing A9 bridge crossing and the Highland Main Line railway, and also a short reach downstream of the new bridge structure. Operation of two road drainage outfalls would potentially affect flow and sediment regimes and would permanently remove a portion of the riparian zone, however it is noted that the banks of Inchewan Burn are currently modified at these locations. This is considered to have a potential impact of moderate magnitude resulting in the potential for an effect of Moderate significance on the water feature.

10.4.84 The potential impacts on the River Braan (WF11) for hydromorphology are anticipated to be similar as those associated with Option ST2A and Option ST2B, however with a greater permanent loss of riparian zone and modification to approximately 140m of the banks. This is due to the raised A9 bridge structure and its associated embankments. This could affect lateral connectivity and potentially impact the flow regime during high flows. These structures would have the potential to locally change the channel cross-section and alter flow dynamics. Given the extent of the modification of the banks, these potential impacts could lead to the loss of morphological features upstream and downstream and the potential for increased flow velocities during flood events, with a potential impact of moderate magnitude resulting in the potential for an effect of Very Large significance on the River Braan.

Surface Water Quality

10.4.85 There are anticipated to be no specific impacts or effects in addition to those reported as common to all proposed route options.

Surface Water Supply

10.4.86 There are anticipated to be no specific impacts or effects in addition to those reported as common to all proposed route options.

<u>Impacts and Effects Specific to Option ST2D (Operation)</u>

10.4.87 This section presents the potential for effects of Moderate or greater significance that are specific to Option ST2D for the operational phase, and which are additional to those reported as common to all.

Flood Risk

10.4.88 The potential impacts and effects on the crossing of WF5A are anticipated to be the same as those for Option ST2B (refer to paragraph 10.4.73). This is considered to be a potential impact of major magnitude resulting in the potential for an effect of Moderate significance.

10.4.89 The potential impacts on the River Braan (WF11) and River Tay (WF6) are considered to be the same as those for Option ST2A (refer to paragraphs 10.4.66 and 10.4.67) with a potential impact of major beneficial magnitude resulting in the potential for an effect of Very Large beneficial significance on the River Braan (WF11), major beneficial magnitude resulting in the potential for an effect of Large beneficial significance on Mill Stream (WF12) and minor beneficial magnitude resulting in the potential for an effect of Moderate beneficial significance on the River Tay (WF6). However, it is noted that the areas upstream of the River Braan (WF11) crossing and along the River Tay that are at risk of flooding in the baseline situation would remain at significant risk (potential for effect of Very Large significance) despite these beneficial impacts.

Hydromorphology

10.4.90 The potential impacts and effects on Inchewan Burn (WF8) for hydromorphology are considered to be the same as those reported for Option ST2C (refer to paragraph 10.4.83) with a potential impact of moderate magnitude resulting in the potential for an effect of Moderate significance.

10.4.91 The potential impacts on the River Braan (WF11) for hydromorphology are considered to be the same as those associated with Option ST2A and ST2B (refer to paragraph 10.4.84) with a potential impact of moderate magnitude resulting in the potential for an effect of Large significance on the River Braan.

Surface Water Quality

10.4.92 There are anticipated to be no specific impacts or effects in addition to those reported as common to all proposed route options.

Surface Water Supply

10.4.93 There are anticipated to be no specific impacts or effects in addition to those reported as common to all proposed route options.

10.5 Potential Mitigation

Introduction

10.5.1 The objective of this section is to outline mitigation measures to avoid/prevent, reduce or offset potential impacts and effects described in Section 10.4 (Potential Impacts and Effects). At this stage, these mitigation measures are indicative only and would be developed and refined as part of the DMRB Stage 3 assessment.

10.5.2 Essential mitigation is defined within DMRB LA 104 as those that are '*critical for the delivery of a project which can be acquired through statutory powers*'. These are measures not embedded in the scheme design, but measures committed to during later stages of the project to avoid and reduce potential impacts. Essential mitigation measures that are required to avoid, prevent, reduce, or offset all potential impacts, considering best practice, legislation and guidance, during both construction and operation.

Construction

10.5.3 All of the proposed route options would require mitigation in the form of good practice as a minimum, which are detailed below:

- Consideration should be given to locating construction yards and storage areas outside the floodplain to reduce the risk of movement/damage and increased flood risk elsewhere during potential flooding events.

- Consideration should be given to temporary protection of sensitive receptors at risk of flooding such as use of demountable flood barriers.
- Duration and spatial extent of works should be minimised and adequate pollution and sediment control measures in place.
- Rehabilitation of exposed areas as soon as possible after the work has been completed to reduce the risk of sediment release and additional runoff into channels.
- For relevant in-channel works, apply for licences from SEPA under the requirements of CAR.
- For in-channel works, enhancement of channel elsewhere in the same catchment could compensate for lost habitat. Examples include increasing channel sinuosity, increasing flow type diversity and riparian enhancement.
- Undertaking potentially polluting activities (e.g. concrete batching and mixing) and locating stockpiles away from water features and drains.
- Installation of water crossings, bridge demolition and in-channel works during low flow and using appropriate methods to reduce the risk of pollution. In-channel works should be carried out in accordance with SEPA's Engineering in the Water Environment: Good Practice Guide – River Crossings (2010) to ensure that fish passage through culverts is maintained during construction (refer to Volume 1, Part 3 – Environmental Assessment (Chapter 11: Biodiversity)).
- Appropriate method of working for outfall construction including adherence to SEPA's Good Practice Guide: Intakes and Outfalls (SEPA, 2019c) and DMRB CD 529 Design of outfall and culvert details (Highways England et al., 2020).
- Adherence to SEPA's Pollution Prevention Guidelines (PPGs) and Guidance for Pollution Prevention (GPPs) (SEPA, Various).
- Installation of temporary treatment facilities to protect water quality and promote flow attenuation during construction. These should be agreed with SEPA prior to commencement of construction as part of the CAR authorisation process for construction sites, following The Water Environment (Miscellaneous) (Scotland) Regulations 2017 and CIRIA's guidance including C648 (CIRIA, 2006a), C649 (CIRIA, 2006b), C698 (CIRIA, 2007) and C753 (CIRIA, 2015).
- Contractor to develop a Pollution Incident Response Plan and Methods Statements for activities involving in-channel works and potentially polluting activities, including spillage response measures.
- Contractor to prepare a Construction Environmental Management Plan (CEMP), agreed with SEPA prior to commencement of works.
- At sites sensitive to the effects of flood risk, where construction activities may increase flood risk compared with the pre-construction situation, appropriate flood mitigation (appropriately sized channel diversions) and warning methods should be adopted to alert construction teams of potential flood risk and give time to take appropriate action to reduce the risk.
- Water quality monitoring to be undertaken prior to, during and post-construction.

10.5.4 Further detailed mitigation in the form of both standard measures applicable across the A9 dualling projects (Essential Standard Mitigation) and also project-specific measures (Essential Specific Mitigation) would be developed at DMRB Stage 3. However, given the duration and extent of works required to achieve the vertical realignment of Inchewan Burn for Option ST2A and Option ST2B an appropriately qualified geomorphologist would be required to oversee the construction of the new structure. An indicative construction sequence to mitigate flood risk and reduce the potential effects to downstream water quality on Inchewan Burn has been developed. The construction sequence includes an offline diversion of Inchewan Burn around the works area in a box culvert. The culvert would be sized to convey a flow return period proportionate to the duration of the construction of the permanent alignment of Inchewan Burn (WF8). The diversion would isolate flow from construction activities and

safely convey flow into the downstream channel. This would form an essential specific mitigation item to be developed further at DMRB Stage 3 should either Option ST2A or Option ST2B be taken forward.

10.5.5 For Options ST2C and ST2D, an appropriately qualified geomorphologist would be required to oversee remediation of any potential impacts to the morphology of the watercourse.

Operation

Flood Risk

10.5.6 Where floodplain is lost or connectivity reduced, provision of compensatory flood storage can avoid any increase in downstream flood risk. Appropriate attenuation of surface runoff through correctly sized SuDS could also limit flood risk from the introduced impermeable area.

10.5.7 The DMRB Stage 3 assessment would include continued development of the assessment for watercourse crossings. Culvert and bridge crossings should seek to cause no increase in flood risk, particularly to sensitive receptors. If embankments are required in the floodplain, the provision of flood culverts or compensatory flood storage would be incorporated in close proximity, as far as reasonably practicable to the loss of existing floodplain. Mitigation measures within the engineering design (e.g. earthworks, embankments, and road alignment design) would also lessen the potential effects. These design decisions can be elevated through the refinement of hydraulic models at DMRB Stage 3.

10.5.8 Structures may require ongoing inspection and maintenance to prevent blockages. The design would seek to eliminate the need for operational interventions where possible.

10.5.9 There may be small areas of land where some residual increase in flood risk is identified following assessment of flood mitigation measures. In this case, consideration of the importance of flood receptors and magnitude of potential impact is recommended.

10.5.10 For Inchewan Burn (WF8) the risk of blockage due to the vertical channel realignment associated with Options ST2A and ST2B would be mitigated through the use of trash screens and a sediment trap. The trash screen and sediment trap would require ongoing maintenance to ensure that they are effective.

10.5.11 Options ST2A and ST2B require pumping stations to operate as a back-up during exceedance events. The pumps would be designed with sufficient capacity for the 0.1% AEP (1000-year) plus CC event. However, there is a significant risk to the dualled A9 in the event of pump failure or the drainage system being subject to blockage, resulting in flooding of the road within the tunnel (Option ST2A) or underpass (Option ST2B) section. Additional mitigation would be required to reduce this risk to an acceptable level (not significant), including provision of:

- a back-up power supply (alternative mains supply or generators) should the primary power supply fail;
- a maintenance programme for the gravity drainage system to reduce the risk of blockage from material build-up;
- a maintenance programme for the pumping stations including regular testing; and
- an alarm system to alert the trunk road operator to the failure of any system and ponding within the tunnel (Option ST2A) or underpass (Option ST2B).

10.5.12 Additional design development may be required to reduce the potential impact of Option ST2C on the 0.5% AEP (200-year) plus CC flood extent of the River Tay (WF6). Steepening of the road embankment and/or incorporation of retaining walls to reduce the footprint of the road infrastructure within the floodplain between approximate ch4350 to ch4800 together with provision of compensatory flood storage would be required to reduce the potential effect on flood risk.

10.5.13 Hydromorphology In-channel structures/modifications including outfalls, culverts and realignments would need to be designed in line with the appropriate standards/best practice including SEPA's Engineering in the Water Environment: Good Practice Guide: River Crossings: WAT-SG-25 (SEPA, 2010), CIRIA's C609 (CIRIA, 2004), C786 (CIRIA, 2019) and DMRB CD 529 (Highways England et al. 2020). It should include consideration of correct positioning to limit the potential for scour and minimise alteration to flow patterns which may lead to turbulence and/or excessive deflection of flow towards the bed or banks of the channel.

10.5.14 Where channel realignment is proposed it would be recommended that the length of the realignment is minimised, with the existing gradient maintained. The realignment could include low flow channels and other designs to reduce the potential for siltation and could be an opportunity to improve the geomorphology of the water feature.

10.5.15 Ensure that the designs of structures are compliant with the appropriate guidelines and have input from environmental disciplines to allow for mitigation to be incorporated.

10.5.16 For Options ST2A and ST2B on the Inchewan Burn (WF8), sediment transport would be permanently altered due to the vertical realignment of the watercourse. This may be partially mitigated by removing material from a proposed upstream sediment basin and re-distributing the accumulated material in the downstream reach. This would artificially maintain sediment supply to the downstream reach and prevent some of the degradation of the habitat in the lower reach of the watercourse. Material accumulation upstream of the structure would require regular monitoring, which would inform the frequency at which redistribution would be required in the downstream channel. This mitigation would be required for duration of the operational life of Options ST2A and ST2B.

10.5.17 Follow best practice identified in the following:

- SEPA's Position Statement to support the implementation of the Water Environment (Controlled Activities) (Scotland) Regulations 2005: WAT-PS-06-02: Culverting of Watercourses (SEPA, 2006);
- SEPA's Engineering in the Water Environment Good Practice Guide: Bank Protection Rivers and Lochs (WAT-SG-23) (SEPA, 2008);
- SEPA's Engineering in the Water Environment Good Practice Guide: Intakes and Outfalls (WAT-SG-28) (SEPA, 2019c); and
- SEPA's Position Statement to support the implementation of the Water Environment (Controlled Activities) (Scotland) Regulations 2011: WAT-PS-07-02: Bank Protection (SEPA, 2012b).

Surface Water Quality

10.5.18 All of the proposed route options include outfalls that discharge routine road runoff to receiving water features. In Scotland, SuDS is a legal requirement under CAR; a minimum of two levels of SuDS is intended to be included for all mainline outfalls in agreement with SEPA and NatureScot. Table 10.13 outlines the indicative SuDS proposals at this stage; however, these may be subject to change based on design development typically undertaken at DMRB Stage 3. The significance of effect of operational impacts on WF12 and WF12A is considered significant in terms of the EIA regulations (due to the medium importance of the receiving watercourses), as a HEWRAT 'fail' is registering for dissolved Copper for the discharge of routine runoff to WF12 and WF12A, inclusive of the SuDS proposals drainage proposals (filter drains and a detention basin). Therefore, further development and/or further assessment of the SuDS proposals at these locations may be required at DMRB Stage 3. This effect is the same for all proposed route options on these receptors and therefore not considered to be a differentiator.

10.5.19 Figures 10.1 to 10.4 show the indicative location of SuDS basins. Where SuDS basins are currently considered to be impractical/constrained, other treatment/attenuation measures (e.g. swales and

underground components such as vortex separators and geocellular/modular systems) have been considered for the proposed route options in the DMRB Stage 2 design (see Table 10.13). As noted in Volume 1, Part 3 – Environmental Assessment (Chapter 7: Overview of Environmental Assessment), the drainage design would continue to be developed and assessed in detail as part of early work at DMRB Stage 3. This would include review of options to refine shape and position, type of treatment proposed, further consultation with statutory consultees, and liaison with any potentially affected landowners. The final treatment method(s) chosen should be most suitable for the local conditions and easily maintained.

10.5.20 Where SuDS features are proposed, these would be designed in accordance with The SUDS Manual, CIRIA C753 (CIRIA, 2015) and SUDS for Roads (SCOTS, 2010) guidance and assessed in line with SEPA Regulatory Method WAT-RM-08 (SEPA, 2019b).

Table 10.13: Summary of Outfalls and indicative SuDS proposals at DMRB Stage 2.

Receiving Watercourse	SuDS proposals
River Tay (WF6)	**Option ST2A:** Five outfalls each with two levels of treatment (filter drains and detention basins). **Options ST2B, ST2C and ST2D:** Four outfalls each with two levels of treatment (filter drains and detention basins).
Inchewan Burn (WF8)	**Option ST2A:** One mainline outfall. Provision of treatment constrained by cut and cover tunnel structure. Filter drains and hydrodynamic vortex separator proposed. One side road outfall with two levels of treatment (filter drains and a detention basin) **Option ST2B:** Two mainline outfalls. Provision of treatment constrained by underpass, therefore filter drains and hydrodynamic vortex separator proposed. One side road outfall with two levels of treatment (filter drains and a detention basin). **Option ST2C:** Two mainline outfalls with two levels of treatment (filter drains and a detention basin), additional attenuation provided prior to one outfall by geocellular storage during higher flow events due to site constraints. **Option ST2D:** One mainline outfall with two levels of treatment (filter drains and a detention basin), additional attenuation provided by geocellular storage during higher flow events due to site constraints.
River Braan (WF11)	**Common to All Proposed Route Options:** One outfall with two levels of treatment (filter drains and a detention basin)
Mill Stream (WF12)	**Common to All Proposed Route Options:** One outfall with two levels of treatment (filter drains and a detention basin)
WF12A	**Common to All Proposed Route Options:** One outfall with two levels of treatment (filter drains and a detention basin)

10.6 Summary of Route Options Assessment

10.6.1 This section provides a summary of the DMRB Stage 2 assessment of potential effects for the proposed route options considering the anticipated potential mitigation as described in Section 10.5 (Potential Mitigation).

10.6.2 For the comparison of proposed route options, two aspects are considered; whether the potential for residual effects would be considered significant in the context of the EIA Regulations, and whether any of the potential impacts and effects identified differ sufficiently between route options such that they can be considered a differentiator and need to be considered as part of the overall identification of the Preferred Route Option which, as explained in Volume 1, Part 3 – Environmental Assessment (Chapter 7: Overview of Environmental Assessment), takes into account environmental, engineering, economic and traffic considerations.

10.6.3 Prior to mitigation, potentially significant effects are anticipated on all attributes of the surface water environment.

Flood Risk

10.6.4 Generally, the construction phase carries a slightly lower flood risk than the operation phase as it is temporary. The varying estimated construction duration for each option from 2.5-3 years for Option ST2C and Option ST2D to 4-4.5 years for Option ST2B and 4.5-5 years for Option ST2A is notable; the proposed route options with longer construction durations are likely to incur a higher flood risk should works be within the floodplain. However, a full understanding of the potential construction impacts and effects would only develop with the progression of the design and resulting construction methods.

10.6.5 The proposed in channel works at the River Tay (WF6) and the River Braan (WF11) could have the potential to increase flood risk during construction due to in-channel works limiting the channel capacity, however with the adoption of appropriate mitigation developed at DMRB Stage 3 this risk has the potential to reduce to not significant. During operation of the scheme, the embankment works in the floodplain of the River Tay are unlikely to lead to a significant change in flood risk when the potential mitigation measures are considered.

10.6.6 During construction, works in the vicinity of WF7 (Option ST2A only), WF9, WF12, WF13 and WF18 would require a temporary diversion of the watercourse for the duration of the works. This could increase flood risk in areas that would not be considered to be at risk in the baseline situation. For WF18, the baseline risk to the existing A9 could be increased during construction. The potential effect is considered to be significant, however, appropriate construction mitigation developed as part of the DMRB Stage 3 assessment would have the potential to reduce this effect to not significant post-mitigation.

10.6.7 During construction, the lowering works to Inchewan Burn (WF8) associated with Options ST2A and ST2B are considered to have the greatest potential effect (Very Large significance) although the degree of lowering and the longitudinal extent of the works are slightly lesser for Option ST2B. Comparatively, options ST2C and Option ST2D are considered to result in the potential for no significant potential effect post-mitigation. This is due to the construction method being expected to reduce the channel capacity during construction, and the potential for blockage to cause a flooding risk during construction. However, specific mitigation has been considered as part of a planned construction sequence (as described in Section 10.5) which would be developed further at DMRB Stage 3 and would have the potential to reduce this potential effect to not significant for Options ST2A and ST2B.

10.6.8 During operation, all proposed route options have potential impacts of major magnitude resulting in the potential for an effect of Large significance on WF9 and WF13 due to increased culvert length. However, appropriate mitigation developed as part of the DMRB Stage 3 assessment would have the potential to reduce this effect to not significant post-mitigation. Options ST2B, ST2C and ST2D are also anticipated to have an additional effect on WF5A in comparison to Option ST2A due to increased culvert lengths. However, appropriate mitigation developed as part of the DMRB Stage 3 assessment would be expected to reduce this potential effect to not significant post-mitigation.

10.6.9 For Option ST2C, proposed embankment works in the River Tay (WF6) floodplain at ch4400 are larger than the other three proposed route options and it is anticipated that Option ST2C would potentially require compensatory flood storage and/or further design development to reduce the loss of floodplain area. DMRB Stage 3 design development for Option ST2C would need to consider specific locations for compensatory flood storage areas in addition to opportunities to reduce the footprint of the design, for example through steepening of road embankments and/or incorporation of retaining walls, as detailed in Section 10.5 (Potential Mitigation). A reduction of the design footprint in conjunction with appropriately sized and located compensatory flood storage areas would be expected to result in the potential effect on the River Tay (WF6) floodplain reducing to not significant post-mitigation (as reported in Table 10.14).

10.6.10 For all proposed route options, the widening and raising of the A9 River Braan bridge would result in a major beneficial potential impact and the potential for an effect of Large beneficial significance (Mill Stream) and Very Large beneficial significance (River Braan) for flood risk to property in Inver by reducing flood levels by between 250mm and 350mm. However, it is noted that the areas (upstream of the River Braan (WF11) crossing) which are potentially at risk of flooding in the baseline situation would remain at risk for all proposed route options despite these beneficial effects. For Option ST2C, due to the loss of floodplain storage and reduced floodplain conveyance (with a resultant flood level increase of up to 20mm), there is a potential impact of minor magnitude resulting in the potential for an effect of Large adverse significance on the River Tay (WF6). Further flood risk modelling would be required at DMRB Stage 3 to refine the volume and depth of any increase in flood risk as the Preferred Route Option is identified and progressed. At this stage, the potential effect is considered to be significant pre-mitigation, however implementation of appropriate mitigation measures at DMRB Stage 3, in the form of compensatory storage and/or a reduction in design footprint, would be expected to be reduce the effects to not significant post-mitigation.

10.6.11 Due to the depth of the proposed cut and cover tunnel for Option ST2A and the depth of the 150m underpass structure in Option ST2B, pumping would be required to drain the tunnel/underpass effectively during exceedance events. While pumps would be designed to mitigate flood flows to provide a back-up to the gravity fed drainage system, there remains a risk that there would potentially be a pump failure or blockage resulting in risk of flooding to the proposed A9 carriageway. The low points in the road profile would also be susceptible to a residual flood risk as a result of gravity drainage system blockage. As detailed in Section 10.5 (Potential Mitigation), additional mitigation would be required to reduce this risk, including provision of a back-up power supply, a maintenance programme for the gravity drainage system and pumping stations and an alarm system to alert the trunk road operator to any system failures or ponding within the tunnel (Option ST2A) or underpass (Option ST2B). Provided that this mitigation is implemented, the residual risk would be expected to be reduced to an acceptable level (not significant).

10.6.12 The proposed works at Inchewan Burn (WF8) for Option ST2A and Option ST2B introduce the risk of debris blockage and siltation resulting in increased flood risk during operation. The potential effect is considered to be significant, however, appropriate mitigation in the form of a trash screen and sediment trap (with ongoing maintenance) would be developed as part of the DMRB Stage 3 assessment. Therefore, this potential effect is considered to reduce to not significant post-mitigation.

10.6.13 Overall, when considering the essential mitigation that would be developed further at DMRB Stage 3, effects to flood risk as a result of the proposed scheme are similar in nature for the proposed route options. Although there may be some variation in the extent of specific effects between the proposed route options, this is not considered to be a differentiator between proposed route options.

Hydromorphology

10.6.14 Potentially significant effects are anticipated for hydromorphology during construction and/or operation on the River Tay (WF6), WF9, WF12, WF13 and WF14. These effects are considered to be the same for all proposed route options. Following the implementation of mitigation, these potential effects are expected to reduce to not significant (refer to Table 10.14).

10.6.15 There would be more extensive works on Inchewan Burn associated with the A9 carriageway widening and vertical realignment associated with Options ST2A and Option ST2B, compared to Option ST2C and Option ST2D. Demolition of the existing A9 bridge crossing, vertical realignment of the watercourse, construction of a drop structure and new box culvert, as well as construction of a new bridge structure upstream to provide access to properties at Birnam Glen. These works could remove a greater proportion of the riparian zone, locally alter flow dynamics and cause significant changes to sediment delivery downstream. This would contravene RBMP objectives and the WEWS Act. Mitigation measures outlined in Section 10.5 (Potential Mitigation) and in *Appendix A10.2: Inchewan Burn* are expected to reduce long

term potential effects on Inchewan Burn, however, the potential for an effect on hydromorphology of Large significance post-mitigation would remain for both Options ST2A and ST2B. This is therefore considered to be a differentiator between the proposed route options and a comparative assessment is reported in Table 10.14.

10.6.16 There would be more extensive works on the River Braan (WF11) associated with the new River Braan crossing for Option ST2C than for Options ST2A, ST2B and ST2D as the construction of a new grade separated junction at Dunkeld would require a higher and wider A9 bridge structure (and associated embankments) compared to the bridge structure required for Options ST2A, ST2B and ST2D. This results in a greater permanent loss of riparian zone and modification to approximately 140m of the banks. Given the extent of the modification of the banks, these potential impacts could lead to the loss of morphological features upstream and downstream and the potential for increased flow velocities during flood events, with a potential impact of moderate magnitude resulting in the potential for an effect of Very Large significance on the River Braan. However, subject to the development of appropriate mitigation (at DMRB Stage 3) to reduce or offset these impacts in accordance with Good Practice guidance, these potential effects are anticipated to reduce to not significant.

Surface Water Quality

10.6.17 The in-channel activities on Inchewan Burn (WF8) associated with all proposed route options are considered likely to lead to increased siltation, polluted runoff and spillages affecting water quality and aquatic ecology during construction. However, compared to Option ST2C and Option ST2D, the vertical realignment and associated extent of in-channel works of Inchewan Burn for Option ST2A and Option ST2B have the potential for greater effect on water quality and aquatic ecology pre-mitigation. With the inclusion of mitigation, potential effects associated with siltation, polluted runoff and spillage would reduce to not significant. However, the loss of fish passage during operation on Inchewan Burn cannot be mitigated and therefore the potential effect on overall water quality would remain significant for Option ST2A and Option ST2B post-mitigation. This is therefore considered to be a differentiator between the proposed route options and a comparative assessment is reported in Table 10.14.

10.6.18 Options ST2A and ST2B have the potential to impact on Ladywell Landfill with risk of disturbance to the drainage network and treatment mechanisms at the site, with a potential impact of major magnitude resulting the potential for an effect of Large significance pre-mitigation. With appropriate mitigation, which would be developed further as part of DMRB Stage 3, these potential effects are anticipated to reduce to not significant.

10.6.19 For Mill Stream (WF12) and WF12A, the HEWRAT calculation results indicate a 'Fail' post-mitigation (after treatment with the proposed SuDS) for all proposed route options. HEWRAT calculates the dilution potential of pollutants based on the watercourse flow rate under low flow conditions and also takes into account the river velocity to estimate whether sediment is likely to accumulate. For the Mill Stream (WF12) and WF12A, the Q_{95} values are relatively low. Taking into account the importance (medium) of these watercourses and a potential impact of major magnitude the potential for an effect of Large significance is reported. WF12 does not contain suitable habitat for protected species and is not accessible for migratory salmonids; WF12A currently receives untreated runoff from the existing A9 and is culverted for most of its length prior to discharging into the River Tay (WF6). Given these effects are common to all proposed route options, they are not considered to be a differentiator. Further assessment and/or development of the SuDS proposals at these locations would be undertaken at DMRB Stage 3 to refine the proposed treatment to reduce potential effects to not significant.

Surface Water Supply

10.6.20 Potential impacts to surface water quality in the River Tay during construction (described in Table 10.9) may subsequently result in a partial change to surface water supply. With appropriate mitigation, which would be developed further as part of DMRB Stage 3, these potential effects are anticipated to reduce to not significant

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Table 10.14: Summary of Assessment Post Mitigation – Road Drainage and the Water Environment

Chapter/Subcategory			Water feature	Residual Effects				Comments
				Option ST2A	Option ST2B	Option ST2C	Option ST2D	
Road Drainage and Water Environment	Construction and Operation	Flood Risk	All Water Features	Not Significant	Not Significant	Not Significant	Not Significant	During construction significant effects on flood risk are predicted for all options, however, with the implementation of appropriate mitigation during construction, these effects are considered to be not significant. Options ST2A and ST2B carry an additional increased flood risk during construction; an indicative construction sequence has been developed for these options which would be necessary to reduce these effects to not significant. During operation, effects on the floodplain of the River Tay (WF6) for Options ST2C are not considered to be significant taking into consideration further design development. Beneficial effects on the River Braan (WF11). During operation the vertical alignment of Options ST2A and ST2B would require pumping as a back-up during exceedance events. As detailed in Section 10.5 and 10.6, additional mitigation would be required to reduce the risk of flooding in event of a blockage or pump failure. Provided that this mitigation is implemented, the residual risk could be reduced to an acceptable level (not significant). With regards to flood risk, the proposed route options are similar in nature. However, Options ST2A and ST2B are considered to have a slightly greater effect due to the potential residual flood risk to the new carriage way in the event of a failure or blockage of the pump system. The differences between proposed route options in relation to flood risk are not considered sufficient to be a differentiator.
		Hydromorphology	All Water Features	Large (Inchewan Burn only)	Large (Inchewan Burn only)	Not Significant	Not Significant	Pre-mitigation, the more extensive works on Inchewan Burn (WF8) associated with Options ST2A and ST2B would result in an effect of Very Large significance, compared to an effect of Moderate significance for Option ST2C and Option ST2D. Post-mitigation, the effects associated with Options ST2A and ST2B would remain of Large significance This is considered sufficient to be a differentiator between the proposed route options. Effects associated with Options ST2C and ST2D would reduce to not significant post-mitigation. For all other water features, effects are reduced to not significant post-mitigation. Based on this post-mitigation Options ST2C and ST2D have a lesser residual effect on hydromorphology than Options ST2C and ST2B.

Chapter/Subcategory			Water feature	Residual Effects				Comments
				Option ST2A	Option ST2B	Option ST2C	Option ST2D	
Road Drainage and Water Environment	Construction and Operation	Surface Water Quality	All Water Features	Large (Inchewan Burn only)	Large (Inchewan Burn only)	Not Significant	Not Significant	Pre-mitigation, there are a greater number and more extensive in-channel activities associated with Options ST2A and ST2B (including loss of fish passage), compared to Options ST2C and ST2D on Inchewan Burn (WF8). This results in an effect of Large significance for Options ST2A and ST2B, compared to Moderate significance for Option ST2C and ST2D during construction. Post-mitigation, the effects associated with Options ST2A and ST2B would remain of Moderate significance. Effects associated with Options ST2C and ST2D would reduce to not significant post-mitigation. This is considered sufficient to be a differentiator between the proposed route options. During operation, for Mill Stream (WF12) and WF12A, the HEWRAT calculations results indicate a 'Fail' post-mitigation (after treatment with SuDS) for all proposed route options. Considering the importance of these watercourses this effect is considered to be significant, however is not a differentiator between the proposed route options. Further development of the SuDS proposals and/or further assessment at these locations would be undertaken at DMRB Stage 3 to reduce these impacts to not significant. For all other water features, effects are reduced to not significant post-mitigation. Based on this post-mitigation Options ST2C and ST2D have a lesser residual effect on surface water quality than Options ST2C and ST2B.
		Surface Water Supply	N/A	Not Significant	Not Significant	Not Significant	Not Significant	During construction significant effects to surface water supply are predicted for all proposed route options, however, with the implementation of appropriate mitigation during construction, these effects are considered to be not significant. With regards to surface water supply, the differences between proposed route options are not considered sufficient to be a differentiator.

Compliance Against Plans and Policies

10.6.21 DMRB LA 104 states that environmental assessment, reporting and monitoring shall meet the requirements of the national planning policy for each relevant Overseeing Organisation.

10.6.22 *Appendix A21.1 (Assessment of Policy Compliance)* provides a review of national, regional and local policy documents which are of relevance to this assessment undertaken and reported in this chapter in accordance with DMRB guidance.

10.6.23 National planning policy objectives (and accompanying best practice guidance) of relevance to this assessment are provided in National Planning Framework 3 (Scottish Government, 2014b), Scottish Planning Policy (SPP) (Scottish Government, 2014a; Revised 2020) themes 'Valuing the Natural Environment' and 'Managing Flood Risk and Drainage' as well as PAN 61 (Planning & SuDS) (Scottish Executive, 2001) and PAN 79 (Water & Drainage) (Scottish Executive, 2006). In addition, local policies of relevance include Perth and Kinross Local Development Plan 2 (PKC LDP2) (PKC, 2019) Policies 52 (New Development and Flooding) and 53 (Water Environment and Drainage) as well as TAYplan Policy 2 (Shaping Better Quality Places) (TAYplan, 2017).

10.6.24 A full policy compliance assessment can be found in Table 3 of *Appendix A21.1 (Assessment of Policy Compliance)*. Overall, the assessment of the proposed route options has had regard to national, regional and local flood risk policy objectives, in addition to proposing mitigation and management measures to reduce flood risk as a result of the options. However, hydromorphology and surface water quality impacts upon Inchewan Burn as a result of Option ST2A and Option ST2B would result in non-compliance with national, regional and local policy due to the likely irreversible nature of the impacts after mitigation. However, at this stage Option ST2A and Option ST2B are not considered to fully comply with relevant policies.

Community Objectives

10.6.25 The community objectives (refer to Volume 1, Part 3 – Environmental Assessment (Chapter 7: Overview of Environmental Assessment, Table 7.2)) have been considered throughout DMRB Stage 2. *Appendix A7.1: Mapping of Community Objectives Against DMRB Stage 2 Route Options* sets out which DMRB Stage 2 environmental topics are relevant to each of the objectives.

10.6.26 *Appendix A7.1: Mapping of Community Objectives Against DMRB Stage 2 Route Options* confirms that community objective 2 is relevant to the assessment of Road Drainage and the Water Environment. Professional judgement has been used to consider how the proposed route options contribute to the community objectives for the operation phase, as summarised in Table 10.15.

10.6.27 The contribution of the operation phase of each of the proposed route options to the relevant community objectives was categorised according to the following key.

Contributes to all/most of the community objective

Contributes to part of the community objective

Contributes to little/none of the community objective

Table 10.15: Contribution to Community Objectives During Operation for this Environmental Topic

Relevant Community Objective		Option ST2A	Option ST2B	Option ST2C	Option ST2D
2	Protect and enhance the scenic beauty and natural heritage of the area and its distinctive character and quality.				

10.6.28 Option ST2A and Option ST2B involve lowering Inchewan Burn into a culvert, resulting in significant adverse potential effects to the natural characteristics of the burn that would continue into operation. As a result of this, Option ST2A and Option ST2B are not considered to contribute to community objective 2. Option ST2C and Option ST2D would preserve Inchewan Burn in its current course, allowing them to contribute to community objective 2.

Comparative Assessment

10.6.29 Consideration of the differences in potential effects associated with each of the proposed route options allows for a comparative assessment as provided in Table 10.16. This comparative assessment has taken into account the potential effects of each of the proposed route options on road drainage and the water environment, with consideration of the potential mitigation measures. Due to the potential effect of Large significance on hydromorphology and surface water quality for Inchewan Burn for Option ST2A and Option ST2B post-mitigation, these would have the highest overall effect. Option ST2C and Option ST2D are assessed to have no significant potential effects post-mitigation and therefore have the lowest overall effect.

Table 10.16: Comparative Assessment - Road Drainage and the Water Environment

Route Option	Lowest Overall Effect	Intermediate Overall Effect	Highest Overall Effect
Option ST2A			✓
Option ST2B			✓
Option ST2C	✓		
Option ST2D	✓		

10.7 Scope of Stage 3 Assessment

10.7.1 It is proposed that the DMRB Stage 3 assessment for Road Drainage and the Water Environment would be undertaken in accordance with the DMRB LA113.

10.7.2 Consultation with SEPA regarding the lowering of Inchewan Burn (Options ST2A and ST2B) was carried out in September and November 2018. This is due to the potential significant effects associated with these works on Inchewan Burn (WF8) for Flood Risk, Hydromorphology and Surface Water Quality. Further consultation with SEPA regarding these works would be required should Options ST2A or ST2B be taken forward to DMRB Stage 3.

Flood Risk

10.7.3 The DMRB Stage 3 assessment would include continued development of the hydrological and hydraulic modelling (including revised climate change allowance) undertaken at DMRB Stage 2, including the further development of assessment for the crossings of small water features (including those identified as having a high (WF7) or very high (WF9 and WF13) importance), Inchewan Burn (particularly with Options ST2A and ST2B) and localised potential effects on the River Tay and River Braan floodplains.

10.7.4 Design opportunities would be identified to minimise potential impacts and effects on the floodplain (particularly with Option ST2C). This would include the location, profile, and form of earthworks to minimise the potential loss of floodplain.

10.7.5 Target areas for the provision of compensatory flood storage would be identified at an early stage for inclusion in the modelling. The SuDS proposals would also be incorporated into the modelling.

10.7.6 Each minor watercourse crossing would be designed and assessed to minimise flood risk to the proposed route and surrounding receptors.

Hydromorphology

10.7.7 Opportunities to improve the status of affected water features, such as improving fish passage (removal of barriers) and improving channel morphology would be considered and recommendations would inform the DMRB Stage 3 design, where feasible.

10.7.8 Geomorphological input would inform the design of watercourse crossing structures, channel realignments and associated works.

10.7.9 It is envisaged that much of the information collated and reported as part of the DMRB Stage 3 assessment would be used to support the CAR Applications. The approach and requirements of the CAR Applications would follow SEPA guidance, and the programme of delivery would be agreed with SEPA and Transport Scotland.

Surface Water Quality

10.7.10 Further assessment of the risks to surface and groundwater quality would be undertaken using the revised Highways England Water Risk Assessment Tool (HEWRAT), Simple Index Approach, UKTAG Rivers and Lakes Metal Bioavailability Assessment Tool (M-BAT) in-line with DMRB LA 113 (Highways England et al, 2019) and SEPA WAT-RM-08 (SEPA, 2019b).

10.7.11 More detailed water quality assessments would be considered on a location-by-location basis, in agreement with SEPA and NatureScot. The A9 Dualling Programme: Pass of Birnam to Tay Crossing Habitats Regulations Appraisal (DMRB Stage 2) may be a key driver for more detailed modelling work should works have the potential to impact sensitive ecological interests in proximity to the proposed outfalls.

Surface Water Supply

10.7.12 A review of potential impacts and effects on surface water supplies and private water supplies will be undertaken at DMRB Stage 3 with consideration to the more detailed design and construction methodology.

10.8 References

National Legislation and EU Directives

European Commission (2000). Council Directive (2000/60/EC) Water Framework Directive

Scottish Government (2003). Water Environment Water Services Act 2003

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11. Biodiversity

11.1 Introduction

11.1.1 This chapter presents the results of the Design Manual for Roads and Bridges (DMRB) Stage 2 Ecological Impact Assessment (EcIA) for each of the proposed route options. The assessment considers the potential impacts and associated effects on biodiversity resources, which comprises terrestrial and freshwater species, habitats and ecosystems.

11.1.2 The assessment is informed by a desk-based review of available information, including an extended Phase 1 habitat survey previously conducted by AECOM (formerly Scott Wilson/URS) (Transport Scotland, 2014a). The 2014 Phase 1 habitat survey data was augmented through consultations and updated with extended Phase 1 habitat surveys undertaken by Jacobs in 2019 to document any updates to mapped Phase 1 habitats. In addition to desk-based information, a range of targeted ecological surveys for species of conservation interest, undertaken between 2015 and 2020, were used to assess each proposed route option.

11.1.3 This DMRB Stage 2 assessment is presented in the context of the existing baseline of the A9 corridor. This means that many potential effects on biodiversity resources associated with road operations are already experienced by the species and habitats in the area of the existing A9; however, the level of impact of these effects, once the A9 is dualled, could potentially be greater than these baseline conditions.

Legislative and Policy Background

11.1.4 This assessment is directed by legislation, national policies and recognised best practice guidance. Legislation and conventions relevant to this assessment are summarised in Table 11.1 and relevant policies are described in paragraphs 11.1.5 to 11.1.9. Further details are described in Volume 1, Part 3 – Environmental Assessment (Chapter 21: Policies and Plans and *Appendix A21.1: Assessment of Policy Compliance*), and as described in Volume 1, Part 3 – Environmental Assessment (Chapter 7: Overview of Environmental Assessment) relevant pre-Brexit EU legislation now transposed into UK law is also referenced.

Table 11.1: Relevant legislation and conventions

Legislation and Conventions	Summary
EU Exit Legislation	
European Union (Withdrawal Agreement) Act 2020	Refer to Volume 1, Part 3 – Environmental Assessment (Chapter 7: Overview of Environmental Assessment) for details of the implications of the UK's withdrawal from the EU on domestic retained EU law. For the purposes of this assessment the domestic retained EU law is referred to in accordance with its original European Commission reference.
International	
The Birds Directive (2009/147/EC)	The European Union (EU) Directive on the Conservation of wild birds (79/409/EEC) was adopted in 1979 and amended in 2009 to become the Directive (2009/147/EC). The Birds Directive is a primary tool for delivering EU obligations under the CBD (as detailed above), and the Ramsar and Bonn (CMS) Conventions. Through the Birds Directive and the Habitats Directive, Member States are required to undertake measures to conserve and maintain all naturally occurring populations of bird species listed on Annex I of the Directive, and migratory species, across the EU through the designation of Special Protection Areas (SPAs); this includes actions to protect the birds, their sites, and their habitats.

Legislation and Conventions	Summary
Council Regulations (EC) No 1100/2007 Establishing Measures for the Recovery of the Stock of European Eel	These regulations establish measures for the recovery of the European eel stock by requiring EU Member States to put in place an Eel Management Plan for their river basin districts (RBD), to reduce eel mortality as a result of human activities.
The Convention on Biological Diversity (CBD)	The CBD was adopted in 1992 at the international Conference on Environment and Development (the 'Earth Summit') and entered into force in 1993. The CBD is an international and legally-binding treaty that commits signatories to three main goals of: conserving biodiversity; sustainable use of biodiversity; and the fair and equitable sharing of the benefits arising from the use of genetic resources. The aim of these goals is to promote actions for a sustainable future. The UK ratified the CBD in 1994 and established the UK Biodiversity Action Plan (1992-2012) to deliver the CBD objectives. This was superseded by the Strategic Plan for Biodiversity 2011-2020 and the Aichi Targets (20 global targets) to be met by 2020. The UK Post-2010 Biodiversity Framework is overseen by the Four Countries' Biodiversity Group. In Scotland, the Scottish Biodiversity Strategy was established with goals for 2020. The Scottish Government published its Scottish biodiversity strategy post-2020 statement of intent on 14 December 2020 in preparation for the CBD Conference of the Parties 15 in 2021.
The Habitats Directive (92/43/EEC)	The EU Directive (92/43/EEC) on the conservation of natural habitats and of wild fauna and flora (Habitats Directive) was adopted in 1992 and is the means by which the European Community (EC) meets its obligations as a signatory of the Bern Convention. The Directive introduces a range of measures including the protection and surveillance of habitats and species. The main aim of the Directive is to promote the maintenance of biodiversity by requiring Member States to take measures to maintain or restore natural habitats and wild species at a favourable conservation status, introducing robust protection for those habitats and species of European importance. The habitats listed in Annex I of the Directive, and the species listed in Annex II, are to be protected by means of a network of sites. Each Member State is required to prepare and propose a national list of sites for evaluation in order to form a European network of Sites of Community Importance (SCIs). Once adopted, these are designated by Member States as SACs and, along with SPAs classified under the Birds Directive after 1994, form a network of protected areas known as Natura 2000 (now referred to in the UK as European Sites).
The Convention on the Conservation of Migratory Species of Wild Animals (the Bonn Convention or CMS)	The CMS was adopted in 1979 and entered into force in 1983. The CMS in an international and environmental treaty of the United Nations, and acts as a framework Convention to conserve and protect migratory species, their habitats, and their migration routes, notably those that cross international borders. The UK ratified the CMS in 1985 and established protection of Appendix I species in the Wildlife and Countryside Act 1981 (as amended).
The Convention on the Conservation of European Wildlife and Natural Habitats (the Bern Convention)	The Bern Convention was adopted in 1979 and entered into force in 1982. The Bern Convention is an international and legally-binding treaty that aims to conserve and protect wild plant and animal species and their natural habitats, to increase cooperation between parties, and to regulate exploitation of migratory species. Through the Bern Convention, internationally, there are legal obligations on signatories to protect over 500 wild plant species and over 1,000 wild animal species. The UK ratified the Bern Convention in 1982 and transposed the obligations into UK law through the Wildlife and Countryside Act 1981 (as amended) and, in Scotland, the Nature Conservation (Scotland) Act 2004 (as amended).
The Convention on Wetlands of International Importance especially as Waterfowl Habitat (the Ramsar Convention)	The Ramsar Convention was adopted in Ramsar, Iran, 1971, and entered into force in 1975. The Ramsar Convention is an international treaty that provides the mechanism for protecting wetland sites of global importance through: designation of wetlands of international importance as Ramsar sites; the promotion of the wise use of wetlands; and international cooperation to further the wise use of wetlands and their resources. The UK ratified the Ramsar Convention and designated its first Ramsar sites in 1976.

Legislation and Conventions	Summary
National	
The Conservation (Natural Habitats, &c.) (EU Exit) (Scotland) (Amendment) Regulations 2019	The Conservation (Natural Habitats, &c.) Regulations 1994 (as amended in Scotland) remain in place post 31 December 2020 with only minor changes being introduced by the Conservation (Natural Habitats, &c.) (EU Exit) (Scotland) (Amendment) Regulations 2019. The Regulations extend to Scotland only.
Wildlife and Natural Environment (Scotland) Act 2011	The Wildlife and Natural Environment (Scotland) Act 2011 (referred to as the WANE Act) amended wildlife laws in Scotland, including the Wildlife and Countryside Act 1981 and the Protection of Badgers Act 1992. It primarily covers management for game species, but also provides a mechanism for the management of invasive non-native species. The WANE Act expanded the Biodiversity Duty placed on public bodies by the Nature Conservation (Scotland) Act 2004 by introducing a requirement for all public bodies to report on their compliance with the Biodiversity Duty.
The Freshwater Fish Conservation (Prohibition on Fishing for Eels) (Scotland) Regulations 2008	Under the Water Framework Directive (WFD), Scotland comprises one singular RDB (the Scotland RBD) and shares the Solway-Tweed RBD with England. An Eel Management Plan was created for Scotland in 2010. Eel protection measures are enshrined in Scots law by the Freshwater Fish Conservation (Prohibition on Fishing for Eels) (Scotland) Regulations 2008.
Nature Conservation (Scotland) Act 2004	This Act places duties on public bodies in relation to the conservation of biodiversity. It also amends and strengthens existing nature conservation legislation and increases protection for SSSIs. In addition, the Act places a duty on every public body to further the conservation of biodiversity and requires Scottish Ministers to designate one or more strategies for the conservation of biodiversity, such as the Scottish Biodiversity Strategy. It also requires Scottish Ministers to publish a list of habitats and species considered to be of principal importance for biodiversity: the Scottish Biodiversity List (SBL) (NatureScot, 2020) is intended to be a tool for public bodies and is an important source of information and guidance for those seeking to conserve biodiversity.
The Salmon and Freshwater Fisheries (Consolidation) (Scotland) Act 2003	The Salmon and Freshwater Fisheries (Consolidation) (Scotland) Act 2003 protects both Atlantic salmon and sea trout, the seaward migrating life form of brown trout. This Act makes it an offence to knowingly injure, disturb, destroy, buy or sell an Atlantic salmon eggs, smolt, fry, parr or alevin; and obstruct the migratory passage of any life stage of Atlantic salmon or sea trout individuals.
The Conservation (Natural Habitats, &c.) Regulations 1994 (as amended in Scotland)	*The UK was a Member State of the EU when this legislation was formalised. Following the UK's withdrawal from the EU, this legislation has now been transferred into domestic 'retained EU law.'* The Conservation (Natural Habitats, &c.) Regulations 1994 (as amended in Scotland) transpose the EC Habitats Directive into national law. The Regulations provide for the designation and protection of 'European sites', the protection of 'European Protected Species', and the adaptation of planning and other controls for the protection of European sites. Under the Regulations it is an offence (subject to exceptions) to deliberately capture, kill, disturb, or trade in the animals listed in Schedule 2 of the Regulations; or to pick, collect, cut, uproot, destroy, or trade the plants listed in Schedule 4. These actions can, however, be made lawful through the granting of licences by the appropriate authorities. Licences may be granted for a number of purposes (such as science and education, conservation, and preserving public health and safety), but only after the appropriate authority is satisfied that there are no satisfactory alternatives and that such actions will have no detrimental effect on the conservation status of the species concerned.
The Wildlife and Countryside Act 1981 (as amended)	The Wildlife and Countryside Act 1981 (as amended) is the principal mechanism for wildlife protection in the UK and it was enacted primarily to implement the requirements of the Bern Convention and the Birds Directive. The Act governs provision of site protection measures under the statutory designation of Sites of Special Scientific Interest (SSSIs).

National Policy

Biodiversity Action Plan

11.1.5 The land and water the proposed route options intersect is covered by the Tayside Local Biodiversity Action Plan (LBAP) (Tayside Biodiversity Partnership, 2016) which, through adopting an ecosystem approach to biodiversity protection and enhancement, aims to deliver Tayside's vision for a fully functioning ecosystem network by 2030. The LBAP provides a biodiversity list of priority protected species and identifies objectives and targets for the conservation of six ecosystems, including the habitats and species present within them, namely:

- water and wetland;
- coastal and marine;
- urban;
- upland;
- farmland; and
- woodland.

11.1.6 Table 11.5 details whether a biodiversity resource is listed in the Tayside LBAP.

Scottish Biodiversity Strategy

11.1.7 The Scottish Biodiversity Strategy comprises two published documents:

- Scotland's Biodiversity: It's in Your Hands (Scottish Executive, 2004); and
- 2020 Challenge for Scotland's Biodiversity (Scottish Government, 2013).

11.1.8 The strategy aims to promote sustainable development by ensuring that biodiversity values and opportunities are integrated into national and local development and planning processes and are taken fully and efficiently into account in the decision-making process (Scottish Executive, 2004; Scottish Government, 2013). Potential impacts and effects on biodiversity has been considered and addressed within this assessment through proposed mitigation.

Scottish Biodiversity List (SBL)

11.1.9 The SBL (NatureScot, 2020) is the statutory list of animals, plants and habitats considered by the Scottish Ministers to be most important for biodiversity conservation in Scotland. The publication of the SBL satisfies the requirements of the Nature Conservation (Scotland) Act 2004, which places a duty on public bodies to further the conservation of biodiversity. Table 11.5 details whether a biodiversity resource is listed in the SBL.

11.2 Approach and Methods

11.2.1 The approach to this assessment is based on the guidance provided by:

- DMRB LA 104 'Environmental assessment and monitoring' (Highways England et al., 2020a);
- DMRB LA 108 'Biodiversity' (Highways England et al., 2020b); and
- DMRB LD 118 'Biodiversity design' (Highways England et al., 2020c)

11.2.2 In addition to the above DMRB guidance, other policy documents and published guidance taken into account in the preparation of this chapter include:

- the Chartered Institute for Ecology and Environmental Management's (CIEEM) Guidelines for Ecological Impact Assessment in the UK and Ireland (CIEEM, 2018);
- Developing a Mitigation Monitoring Approach for the A9 and A96 Dualling Projects (Macdonald-Smart, 2017);
- Scottish Transport Appraisal Guidance (STAG) (Transport Scotland, 2014b);
- Environmental Impact Assessment Handbook (SNH, 2018);
- A9 Route Improvement Strategy – Dualling of Birnam to Tay Crossing, Stage 2 Options Assessment Report (Transport Scotland, 2011), Addendum Report and Ecology Surveys Technical Note (Transport Scotland, 2014c and 2014a);
- A9 Dualling Programme Strategic Environmental Assessment (SEA), TSSEA9/PAS/01, (Transport Scotland, 2013), Addendum Report and Post-Adoption Statement (Transport Scotland, 2014d, 2014e); and
- Land Use Planning System Guidance Note 31: Guidance on Assessing the Impacts of Development Proposals on Groundwater Abstractions and Groundwater Dependent Terrestrial Ecosystems. Scottish Environment Protection Agency (SEPA, 2017).

11.2.3 The approach and methods have been informed by the recommendations made in the A9 Dualling Programme SEA (Transport Scotland, 2013, 2014d, 2014e). Recommendations for biodiversity related primarily to early engagement with NatureScot (formally Scottish Natural Heritage (SNH)[1]) regarding key constraints identified in the SEA, including SSSI, SAC, and Ancient Woodland Inventory (AWI) sites.

11.2.4 Additional policy and guidance documents are discussed in Volume 1, Part 3 – Environmental Assessment (Chapter 21: Policies and Plans and *Appendix A21.1: Assessment of Policy Compliance*).

DMRB Update Guidance

11.2.5 Previous DMRB guidance focused on the protection of habitats and species; whereas the updated DMRB guidance, released in 2019 and 2020, has shifted the focus to protecting environmental resources, including biodiversity through aspects of environmental net gain, ecosystem services and natural capital. This is because the UK has strengthened its political and legal framework to address the current biodiversity crisis. Scotland aligned with the EU Biodiversity Strategy to 2020 which aims to promote no net loss of biodiversity and ecosystem services (European Union, 2011). Additionally, a statutory Biodiversity Duty is placed on public bodies in Scotland whereby the conservation of biodiversity must be furthered with regard to the Scottish Biodiversity Strategy, and a requirement for all public bodies to report on their compliance with the Biodiversity Duty (Table 11.1). The introduction of the term 'biodiversity resource' in DMRB LA 108 emphasises this shift in protection goals and is reflected and captured within this assessment.

11.2.6 The Economics of Biodiversity: The Dasgupta Review (Dasgupta, 2021) asserts that natural capital (such as species populations, habitats, ecosystem services and abiotic aspects to the environment) should be valued as an asset in addition to produced capital (roads, buildings and factories) and human capital (health, knowledge and skills). Produced capital and human capital increasing at the expense of natural capital is not sustainable. Ecosystems, and therefore the services they provide, are productive, resilient and adaptable if they are biodiverse. One way to ensure that natural capital is maintained or enhanced is through aspects of environmental net gain, which DMRB LA 108 defines as '*an approach to development that aims to leave the natural environment in a measurably better state*'.

[1] Publications and consultation from SNH prior to the rebranding of SNH to NatureScot in August 2020 will be referred to as being from SNH.

Securing Positive Effects for Biodiversity

11.2.7 The Planning Act (Scotland) 2019 requires the National Planning Framework (NPF) to contain a statement about how Scottish Ministers consider development will contribute to "securing positive effects for biodiversity". The 2019 Act does not provide further detail on the scope or content of the statement.

11.2.8 While the term environmental net gain is used in DMRB LA 108, the term 'positive effects for biodiversity' is used in this report in line with the 2019 Act.

11.2.9 At the time of writing, no agreed approach or guidance from the Scottish Government on how to achieve positive effects for biodiversity in Scotland has been published. Guidance from the Scottish Government is expected to be addressed though NPF4, a draft of which is not scheduled to be with the Scottish Parliament until Autumn 2021 (Scottish Government, 2021).

11.2.10 As well as placing an emphasis on securing positive effects for biodiversity, DMRB LA 108 also indicates these effects should be measurable. A widely applied method for measuring positive effects is the use of a metric, such as the Department for Environment, Food & Rural Affairs (Defra) Biodiversity Metric, to calculate biodiversity losses and gains based on assigning values to habitats. Use of a metric such as this requires habitat information such as habitat condition assessment, that is not routinely collected at DMRB Stage 2. Habitat surveys undertaken in 2019 for this assessment are therefore not of sufficient detail to accurately determine positive effects for biodiversity using the Defra metric. More detailed surveys, including the use of the UK Habitat Classification system, would be required at DMRB Stage 3 for the Proposed Route Option should the Defra metric be applied.

11.2.11 Assessing positive effects for biodiversity requires detailed information of loss of biodiversity as a result of development, along with detailed information on mitigation, compensation and enhancement created as part of the development. Based on the level of data used at the DMRB Stage 2, a target of biodiversity no net loss can be predicted with some certainty given the broad habitat classification and standard mitigation designs available at this stage. When further detailed data are collected at DMRB Stage 3, and a detailed mitigation strategy is undertaken, positive effects for biodiversity can be included in the assessment. Therefore, at DMRB Stage 2, lost habitat would be considered to be replaced with like-for-like habitat type to provide no net loss, e.g. woodland loss would be expected to be replaced with woodland planting not grassland.

11.2.12 A high-level comparison for the likely differences between proposed route options will be described during this assessment.

Study Area

11.2.13 The study area extends up to 500m from the existing A9, as shown on Figures 11.1 and 11.2. The study area encompasses the proposed permanent and temporary work footprints of all four proposed route options as well as taking into account the Zone of Influence (ZoI) and standard survey guidance for the biodiversity resources within the surrounding environment that were identified as important for this assessment.

11.2.14 The ZoI is the area(s) over which biodiversity resources can be directly or indirectly affected by biophysical changes as a result of the proposed route options and their associated activities. The ZoI varies for different biodiversity resources depending on the resource's sensitivity, mobility, and habitat. The ZoI can also vary temporally due to seasonal variations in activity, abundance and distribution of different biodiversity resources.

11.2.15 The survey area for specific biodiversity resources was amended following consultation with the consultees listed in paragraph 11.2.29.

11.2.16 This study area is deemed sufficient to assess the impacts of each proposed route option at DMRB Stage 2. The ZoI for all biodiversity resources will be assessed at DMRB Stage 3.

11.2.17 National Biodiversity Network (NBN) searches were undertaken up to 10km from the existing A9 to take into account the highly mobile nature of some species and the level at which some data are available (10km grid square), and to provide landscape ecological context.

Baseline Conditions

Desk-based Assessment

11.2.18 A desk-based assessment was undertaken to review existing relevant literature and to obtain ecological information within the study area and to 10km for some biodiversity resources. This included a review of, and updates to, data collated to inform an earlier environmental assessment (Transport Scotland, 2011), including:

- the extended Phase 1 habitat survey and targeted species surveys (Transport Scotland, 2011, 2014a and 2014c);
- A9 Dualling Programme SEA Addendum Report and Post-Adoption Statement (Transport Scotland, 2014d-e);
- A9 Dualling Programme Habitats Regulations Appraisal (HRA), Programme Level Appropriate Assessment, Updated Issue (Transport Scotland, 2015);
- survey data from Scottish Badgers received April 2020 (*Appendix A11.2: Confidential Data on Protected Species*);
- aquatic data from Scottish Environment Protection Agency (SEPA) received in 2015; and
- protected species information from SNH received in 2015 *(Appendix A11.2: Confidential Data on Protected Species*).

11.2.19 Information for the desk-based assessment was also obtained from the following online resources:

- Joint Nature Conservation Committee (JNCC) website (JNCC, 2021);
- Ancient Woodland Inventory (AWI) (SNH, 2008);
- Native Woodland Survey of Scotland (NWSS) (Patterson et al., 2014);
- NBN Atlas website[2] (National Biodiversity Network, 2021);
- Scotland's Environment website (Scotland's Environment Web Partnership, 2021);
- SEPA River Basin Management Plans Interactive Map (SEPA, 2021a); and
- NatureScot Information Service (NatureScot, 2021a).

Ancient and Native Woodland

11.2.20 The AWI is a database of woodlands identified from historical maps, with woodland listed from either the 1750 Roy maps, or the 1860 first edition Ordnance Survey maps. The woodlands are further categorised into ancient semi-natural woodlands (categories 1a and 2a, woodlands that were assumed to be semi-natural on either of the two maps), long-established woodlands of plantation origin (LEPO) (categories 1b and 2b, woodlands that were assumed to be plantation on either of the two maps), and other

[2] Only records of species governed by open licences allowing for commercial use have been referred to in this assessment. Records are covered by one of the following licences: Creative Commons Attribution 4.0 International (https://creativecommons.org/licenses/by/4.0/); Open Government Licence Version 3 (http://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/).

woodlands on 'Roy' woodland sites (category 3, woodlands that were on the Roy maps but not the first edition Ordnance Survey maps) (NatureScot, 2021b).

11.2.21 Some areas listed on the AWI database within the study area have been subjected to a change in land use sufficient to alter the key characteristics of the habitat or have been mapped inaccurately in the AWI. These include areas that have include urban development, other hard standing and the existing A9. These areas no longer constitute ancient woodland inventory habitat.

11.2.22 These areas of urban development (including hard standing and the existing A9) were identified using aerial photography and subtracted from the total area covered by the AWI.

11.2.23 The Native Woodland Survey of Scotland (NWSS) identified native and non-native woodland habitats throughout Scotland. It predominantly avoided surveying areas of woodland on the AWI categorised as LEPO. However, it did identify areas of woodland on the AWI categorised as semi-natural ancient woodland that has been replanted as non-native plantation (PAWS). This accounts for the discrepancies in the woodland cover identified through the AWI and the NWSS.

Air Quality Assessment for AWI Sites

11.2.24 It is a requirement as part of a EcIA to undertake an air quality assessment of nitrogen deposition on AWI sites as outlined in DMRB LA 108 and within Volume 1, Part 3 – Environmental Assessment (Chapter 15: Air Quality). The model produced to predict the nitrogen deposition rate for DMRB Stage 2 does not differentiate the effects on AWI sites between the proposed route options. It indicates a similar magnitude of change from all the proposed route options. For this DMRB Stage 2 assessment, air quality is not a differentiator between proposed route options.

11.2.25 A refined model would be produced and further detailed ecological surveys would be undertaken at DMRB Stage 3 which would allow for a detailed air quality assessment for the impact and effects on AWI sites from nitrogen deposition to be undertaken at DMRB Stage 3. As such, impacts on AWI sites from nitrogen deposition will not be discussed in this assessment.

Site Surveys

11.2.26 Targeted ecology surveys were conducted by Jacobs between January 2015 and July 2015, and in July 2019, to validate the extended Phase 1 habitat survey data provided by Transport Scotland (2014a) (shown on Figures 11.3 to 11.6). Desk-based assessment and review of consultation data was also undertaken. Further surveys for bats, badger (*Meles meles*), otter (*Lutra lutra)*, and beaver (*Castor fiber*) were conducted in 2016, 2018 and 2019 to update the baseline data collected in 2015, as the presence of these highly mobile species could influence the DMRB Stage 2 optioneering process. All surveys were undertaken by suitably trained, qualified and experienced Jacobs ecologists.

11.2.27 Surveys for protected species were undertaken within 250m (otters) or 100m (all other protected species unless specified below) of the existing A9, which was used as a guide for the survey extent as all potential DMRB Stage 2 proposed route options were not available at the time of survey. Surveys comprised the following:

- bat habitat within 50m of the existing A9 was surveyed, to identify any roosting potential of suitable buildings, structures (such as bridges) and trees (all undertaken between January and July 2015 and between February 2018 and July 2019), which were categorised according to the Bat Conservation Trust (BCT) Good Practice Guidelines (Collins, 2016);
- badger surveys recording field signs including setts, hairs, prints, mammal paths and dung, according to Harris et al. (1989) (undertaken in December 2018);
- otter surveys recording field signs including resting places, spraints, prints, slides, and feeding remains, according to Chanin (2003) (undertaken between September 2018 to April 2019);

- water vole (*Arvicola amphibius*) surveys recording field signs including burrows, droppings and latrines, and feeding signs, according to Strachan et al. (2011) and Dean et al. (2016) (undertaken between June and July 2015);
- beaver surveys recording field signs including resting places, feeding and foraging signs, slides, and prints, according to Campbell-Palmer et al. (2016) (undertaken between September 2018 and February 2019);
- habitat assessments for reptile suitability according to Edgar et al. (2010) (undertaken in May 2015); and
- aquatic habitat visual assessments (including fish habitat suitability) for freshwater pearl mussel (FWPM) (*Margaritifera margaritifera*) and fish species of conservation interest (undertaken in February and September 2015, August 2016 and October 2018), based on the walkover methods described in Hendry and Cragg-Hine (1997) and the Scottish Fisheries Coordination Centre (SFCC) Habitat Surveys Training Course Manual (2007).

11.2.28 Targeted redd count surveys (as per technique described in Youngson et al. (2007)) were also undertaken on the Inchewan Burn between October 2018 and January 2019, to determine whether suitable spawning habitat was present within the watercourse (Hendry and Cragg-Hine, 2003) and investigate its potential utilisation as an Atlantic salmon (*Salmo salar*) spawning site.

11.2.29 Infra-red trigger camera monitoring was also undertaken between 2019 and 2020 along the Inchewan Burn to assess the impacts on habitat fragmentation from Options ST2A and ST2B.

Consultation

11.2.30 A summary of the consultation is reported in Volume 1, Part 3 – Environmental Assessment (Chapter 7: Overview of Environmental Assessment, Section 7.6 (Consultation)). Key consultations that have informed this assessment are summarised in the following paragraphs.

11.2.31 Consultation via the Environmental Steering Group (ESG) included agreement on the survey scope, methods and study areas for the assessed biodiversity resources. Input was provided by the following statutory consultees:

- SNH/NatureScot;
- SEPA;
- Perth & Kinross Council (PKC); and
- Cairngorms National Park Authority (CNPA).

11.2.32 The ESG was also iteratively consulted on various aspects of the ongoing ecological work and on key potential impacts, such as potential loss of AWI sites and crossings over watercourses. Local stakeholders were also consulted for information within the study area.

11.2.33 SNH and SEPA were consulted specifically with regards to the construction and design proposals at Inchewan Burn.

11.2.34 In addition to data provided by the statutory consultees, additional requests for data were also made to the following organisations:

- Marine Scotland (data received between 2015 and 2017);
- British Trust for Ornithology (BTO) (data received between 2015 and 2016);
- Scottish Forestry (formerly Forestry Commission Scotland) (data received in 2015 and 2016);
- Saving Scotland's Red Squirrels (formerly Perth & Kinross Red Squirrel Project) (no data received);

- Perth Museum Biological Records Centre (data received in 2015);
- Raptor Study Groups (data received in 2015 and 2016);
- Royal Society for the Protection of Birds (RSPB) (data received in 2015 and 2016);
- Scottish Badgers (data received between 2015 and 2020);
- Scottish Wildlife Trust (SWT) (no data received);
- Tay District Salmon Fisheries Board (TDSFB) (no data received);
- Tayside Bat Group (data received in 2015); and
- Tayside Biodiversity Partnership (no data received).

Future Baseline

11.2.35 The future baseline is a description of the likely evolution from the current state of biodiversity resources without implementation of the proposed route options (Highways England et al., 2020a, 2020b). The likely future baseline scenario is determined through an assessment of desk-based data and received consultation information. It looks at likely future species and habitat compositions within the study area that may be influenced by other developments.

Assessment of Impacts and Effects

11.2.36 The methodology and criteria used for this assessment follows the guidance set out in DMRB LA 108, supported by DMRB LA 104 and CIEEM Guidelines for Ecological Impact Assessment in the UK and Ireland (CIEEM, 2018). This methodology differs to previously published assessments within the A9 Dualling Programme due to the updates of the DMRB and CIEEM guidance for Environmental Statements.

11.2.37 For this assessment, the following terms and definitions are used (CIEEM, 2018; Highways England et al, 2020a):

- impact – actions or events resulting in changes to a biodiversity resource, such as construction activities removing an area of scrub embankment;
- effect – outcome to a biodiversity resource from an impact, such as potential direct mortality of reptiles during removal of the scrub embankment; and
- significant effect – an effect that either supports or undermines biodiversity conservation objectives for biodiversity resources and is important in the decision-making process for this impact assessment.

11.2.38 Significance of effect was assessed by taking into account the importance/sensitivity of the biodiversity resource, the nature and magnitude of potential impacts (including duration, extent and frequency) and their consequent effects on important biodiversity resources, using criteria as set out below.

<u>Importance</u>

11.2.39 Ecosystems, habitats and species are assigned levels of importance for biodiversity based on the criteria set out in Table 11.2. The importance of a biodiversity resource is assessed on a variety of factors, including but not limited to its rarity, uniqueness, ability to resist or recover from environmental change, function/role within an ecosystem, and level of protection or designation. Professional judgement is used to distinguish between levels of importance where it is deemed that a biodiversity resource is not as important in the context of the study area, as defined in Table 11.2. Justification for importance levels is provided in Table 11.5.

11.2.40 Only important biodiversity resources are subject to impact assessment. Therefore, biodiversity resources that do not meet the criteria for at least 'local importance' are not considered in detail in this assessment.

Table 11.2: Importance criteria for biodiversity resources

Importance	Criteria
International	**Sites** *Includes:* ▪ European sites (including Sites of Community Importance; Special Protection Areas (SPAs); potential SPAs; Special Areas of Conservation (SACs); candidate or possible SACs; and Wetlands of International Importance (Ramsar sites)); ▪ Biogenetic Reserves, World Heritage Sites (where recognised specifically for their biodiversity value) and Biosphere Reserves; and ▪ areas which meet the published selection criteria for those sites listed above but which are not themselves designated as such. **Ecosystems and Habitats** *Ecosystems or habitats which:* ▪ maintain, or are identified as, qualifying communities and assemblages that occur within internationally designated sites or undesignated areas that meet the criteria for designation; and/or ▪ are essential to support viable populations of species of international conservation concern. **Species** *Resident, or regularly occurring, population(s) which:* ▪ contribute to the maintenance of qualifying habitats, communities and assemblages that occur within internationally designated sites or within undesignated areas that meet the criteria for such designation; ▪ if lost, would adversely affect the conservation status or distribution of the species at an international scale; ▪ form a critical part of a wider population at an international scale; and/or ▪ are at a critical phase of the species life cycle at an international scale.
National	**Sites** *Includes:* ▪ Sites of Special Scientific Interest (SSSIs) or Areas of Special Scientific Interest; ▪ National Nature Reserves; ▪ National Parks; ▪ Marine Protected Areas, including Marine Conservation Zones; and ▪ areas which meet the published selection criteria for those sites listed above but which are not themselves designated as such. **Ecosystems and Habitats** *Ecosystems or habitats which:* ▪ maintain, or are identified as, qualifying communities and assemblages that occur within nationally designated sites or undesignated areas that meet the criteria for designation; ▪ are listed as priority in the Scottish Biodiversity Strategy (SBS) (Scottish Government, 2013a 2013b) or are irreplaceable (including but not limited to ancient woodland, and ancient or veteran trees); and/or ▪ are essential to support viable populations of species of national conservation concern. **Species** *Resident, or regularly occurring, population(s) which:* ▪ contribute to the maintenance of qualifying habitats, communities and assemblages that occur within nationally designated sites or within undesignated areas that meet the criteria for such designation; ▪ if lost, would adversely affect the conservation status or distribution of the species at a national scale; ▪ form a critical part of a wider population at a national scale; and/or ▪ are at a critical phase of the species life cycle at a national scale.

Importance	Criteria
Regional	**Sites** *Includes non-statutory designated sites.* **Ecosystems and Habitats** *Ecosystems or habitats which:* ▪ maintain qualifying communities and assemblages that occur within regionally important sites or localities listed as being of conservation importance in the Tayside Local Biodiversity Action Plan (LBAP) (Tayside Biodiversity Partnership, 2016) (including Local Nature Reserves) or within undesignated areas that meet the criteria for such designation; ▪ are identified (including for restoration) in the Tayside LBAP; and/or ▪ are essential to support viable populations of species of regional conservation concern. **Species** *Resident, or regularly occurring, population(s) which:* ▪ contribute to the maintenance of qualifying habitats, communities and assemblages that occur within regionally important sites or localities listed as being of conservation importance in the Tayside LBAP (including Local Nature Reserves), or within undesignated areas that meet the criteria for such designation; ▪ are identified in the Tayside LBAP; ▪ if lost, would adversely affect the conservation status or distribution of the species at a regional scale; ▪ form a critical part of a wider population at a regional scale; and/or ▪ are at a critical phase of the species life cycle at a regional scale.
Authority Area	**Sites** *Includes wildlife/nature conservation sites designated at an authority area level.* **Ecosystems and Habitats** *Ecosystems or habitats which:* ▪ are identified as being of conservation importance within Perth and Kinross within the Tayside LBAP; and/or ▪ are essential to support viable populations of species of conservation concern within the authority area. **Species** *Resident, or regularly occurring, population(s) which:* ▪ contribute to the maintenance of habitats, communities and assemblages that occur within Perth and Kinross within the Tayside LBAP; ▪ if lost, would adversely affect the conservation status or distribution of the species at an authority area scale; ▪ form a critical part of a wider population at an authority area scale; and/or ▪ are at a critical phase of the species life cycle at an authority area scale.
Local	**Sites** *Includes wildlife/nature conservation sites designated at local level.* **Ecosystems and Habitats** *Ecosystems or habitats which:* ▪ are considered to appreciably enrich the habitat resource within the local context, including features of importance for migration, dispersal, or genetic exchange; and/or ▪ are essential to support viable populations of species that are considered to appreciably enrich the habitat resource within the local context. **Species** *Resident, or regularly occurring, population(s) which:* ▪ contribute to the maintenance of habitats, communities and assemblages that appreciably enrich the habitat resource within the local context; and/or ▪ are considered to appreciably enrich the habitat resource within the local context.

Importance	Criteria
Less than Local	Biodiversity resources that are considered to be absent or do not meet any of the above criteria.

Impact and Effect Characterisation

11.2.41 The level of impact is determined by the effect on the biodiversity resource. For the purposes of this assessment, the levels of impact in Table 11.3 were used to summarise the overall characterisation of the impacts and their associated effects in accordance with CIEEM (2018) and DMRB LA 108, including:

- beneficial or adverse effects (either a change that improves the quality of the environment, such as increasing species diversity or habitat availability, or a change that reduces the quality of the environment, such as loss of habitat or pollution of watercourses);
- magnitude and extent of impact and associated effect (the size, amount, intensity and volume of the impact/effect and the spatial or geographical area over which the impact/effect may occur, such as entire habitat loss, partial habitat loss or indication over specific area affected);
- direct or indirect impact and associated effect (such as direct mortality of individuals from vehicle collisions, or indirect mortality of individuals from reduced prey resources due to pollution of watercourses);
- reversibility of effect (an irreversible effect is one from which recovery is not possible within a reasonable timescale or there is no reasonable chance of action being undertaken to reverse it, whereas a reversible effect can be counteracted by mitigation or may spontaneously recover);
- frequency and timing of impact and associated effect (single event, recurring or constant; and whether it coincides with critical life-stages or seasons for the biodiversity resource, such as the bird nesting season);
- duration of impact and associated effect (the duration of the activity and associated impact may differ from the duration of the resulting effect, such as short-term construction activities during the bird nesting season may have long-term implications for the population from breeding failure); and
- likelihood of occurrence of impact or associated effect (certain/near certain, probable, unlikely or extremely unlikely).

11.2.42 The level of impact was defined using the criteria set out in Table 11.3, and identified as either major, moderate, minor or negligible, following the above impact and effect characterisation approach.

11.2.43 All impacts discussed within this assessment are adverse to their respective biodiversity resources and no beneficial impacts have been described.

Table 11.3: Levels of adverse impact and typical descriptions of biodiversity resources

Level of Impact	Typical Description
Major	An impact resulting in a permanent/irreversible reduction in the distribution, health, and/or abundance of a habitat, species assemblage/community or population, in such a way as to negatively alter the integrity or key characteristics of the biodiversity resource.
Moderate	An impact resulting in a temporary/reversible reduction in the distribution, health, and/or abundance of a habitat, species assemblage/community or population, in such a way as to negatively alter the integrity or key characteristics of the biodiversity resource.
Minor	An impact resulting in a permanent/irreversible reduction in the distribution, health, and/or abundance of a habitat, species assemblage/community or population, in such a way as to not alter the integrity or key characteristics of the biodiversity resource.

Level of Impact	Typical Description
Negligible	An impact resulting in a temporary/reversible reduction in the distribution, health, and/or abundance of a habitat, species assemblage/community or population, in such a way as to not alter the integrity or key characteristics of the biodiversity resource.
No change	No observable impact, either beneficial or adverse.

Significance of Effects

11.2.44 The importance of each biodiversity resource and the potential impacts and effects upon them have been determined through the aforementioned collection of data and consultation, and from prior project experience, to provide a robust basis for making a professional decision on the appropriate focus of the impact assessment.

11.2.45 The significance of an effect is determined by the importance of the biodiversity resource (Table 11.2) and the level of impact (Table 11.3). The significance matrix is shown in Table 11.4 and details the significance categories attributed to effects.

11.2.46 DMRB LA 104 and CIEEM (2018) note that impacts that are likely to be relevant in an assessment are those that are predicted to lead to significant effects. Significant effects are those that are likely to support or undermine the conservation objectives of important biodiversity resources. The significance matrix (Table 11.4) is used to determine whether an effect on a biodiversity resource is significant and, therefore, material in the decision-making process.

11.2.47 In DMRB LA 108, where the significance category of an effect is Moderate, Large or Very Large, the effect is considered to be potentially significant. An effect that is determined to be of either slight or neutral significance is not significant and is not considered to be material in the decision-making process.

11.2.48 There may be a number of effects on a biodiversity resource that, whilst not significant individually, may cumulatively result in a significant effect on that biodiversity resource. Where this is identified during the assessment, it is specifically highlighted as a cumulative effect.

Table 11.4: Significance matrix (DMRB LA 108)

Level of Impact / Importance of Biodiversity Resource	No Change	Negligible	Minor	Moderate	Major
International	Neutral	Slight	**Moderate or Large**	**Large or Very Large**	**Very Large**
National	Neutral	Slight	Slight or **Moderate**	**Moderate or Large**	**Large or Very Large**
Regional	Neutral	Neutral or Slight	Slight	**Moderate**	**Moderate or Large**
Authority Area	Neutral	Neutral or Slight	Neutral or Slight	Slight	Slight or **Moderate**
Local	Neutral	Neutral	Neutral or Slight	Neutral or Slight	Slight

11.2.49 Where there is ambiguity in the outcome of the significance matrix, such as a minor impact on a nationally important resource can be either Slight or Moderate significance, professional judgement

shall be used and, if necessary, a precautionary approach will be taken forward where there is not sufficient evidence to determine a lesser effect.

11.2.50 Where potentially significant effects are identified, mitigation measures would be proposed to avoid or reduce potential impacts where feasible. Potential mitigation is discussed further in Section 11.5 (Potential Mitigation).

Community Objectives

11.2.51 At an early stage in the A9 Co-Creative Process, the Birnam to Ballinluig A9 Community Group generated community objectives. The seven objectives are presented in Volume 1, Part 3 – Environmental Assessment (Chapter 7: Overview of Environmental Assessment) and cover a wide range of topics but focus predominantly on environmental issues.

11.2.52 The community objectives have been taken into consideration throughout the DMRB Stage 2 process and a mapping exercise was conducted to indicate how, in the operational phase, the proposed route options could contribute to the relevant objectives. Details of how each environmental topic contributes towards achieving the community objectives is presented in *Appendix A7.1: Mapping of Community Objectives Against DMRB Stage 2 Route Options* and a summary for this chapter is presented in Section 11.6 (Summary of Route Options Assessment).

Limitations to the Assessment

11.2.53 It should be noted that this DMRB Stage 2 assessment was prepared prior to and during the global COVID-19 coronavirus pandemic. Throughout 2020 and in early 2021, there have been significant and extensive restrictions in place in Scotland on the movement of people and the activities that are permitted. Due to the duration and extent of such restrictions, some of the baseline and survey updates have not been achievable.

11.2.54 The Phase 1 surveys conducted in 2013 and 2015 cover the vast majority of the survey buffer (500m out from the existing A9). However, some small land parcels were inaccessible (Figures 11.3 – 11.6) at the time of surveying. These areas are minimal, and the majority are located away from the proposed route options and as such is considered unlikely to change the assessment of differentiators between the proposed route options. These locations will be accessed as part of the DMRB Stage 3 assessment.

11.2.55 Some survey data used for biodiversity resources within the assessment are greater than 18 months old and could be considered outwith the data validity period according to accepted practice (CIEEM, 2019). Where this is the case, it is not considered to materially affect the assessment. The data used is deemed to be sufficient to support a robust assessment at DMRB Stage 2 and will be updated, where appropriate, for the DMRB Stage 3 assessment.

11.3 Baseline Conditions

11.3.1 Biodiversity resources within the study area are described in Table 11.5. The legislation and conservation status of habitats and species is also indicated in Table 11.5, where relevant. Targeted species and habitat site surveys were conducted by Jacobs in 2015, with further surveys undertaken in 2018 and 2019 to complement the desk-based data used for this assessment (details provided in Section 11.2).

Designated Sites

11.3.2 Two statutory designated sites lie within the study area (Table 11.5, Figures 11.1 and 11.2). The River Tay SAC (NatureScot, 2021c) is located north-east of the existing A9 and is crossed by the A9 at the northern end of the study area. Craig Tronach SSSI (NatureScot, 2021d) is located on the northern bank of the River Tay at Dalbeathie, approximately 370m north-east of the proposed route options. The River

Tay SAC also falls within the air quality study area (200m of the proposed route options) for considering designated sites sensitive to atmospheric nitrogen deposition resulting from the proposed route options' traffic emissions (oxides of nitrogen (NO_x)) as identified in Volume 1, Part 3 – Environmental Assessment (Chapter 15: Air Quality). The feature which is most sensitive to NO_x in the River Tay SAC (WF06) is clear water lakes or lochs with aquatic vegetation and poor to moderate nutrient levels (NatureScot, 2021c); however, these are located approximately 7.5km west at the nearest location (Loch Clunie). A qualitative assessment was undertaken using professional judgement and informed by discussions between Air Quality and Ecology specialists. It was determined that changes in NO_x emissions that would result from the proposed route options were unlikely to give rise to significant effects, given their small overall influence on total nitrogen at the site. The River Tay SAC was therefore scoped out of further assessment in respect to NO_x and nitrogen deposition. This is also discussed in Volume 1, Part 3 – Environmental Assessment (Chapter 15: Air Quality).

11.3.3 A detailed consideration of the potential effects on the River Tay SAC, and a further six European sites, in the context of The Conservation (Natural Habitats, & c.) Regulations 1994 (as amended for Scotland) (referred to as the Habitats Regulations), has been undertaken in a Habitats Regulations Appraisal (HRA) for the different DMRB Stage 2 options (Jacobs, 2021).

11.3.4 No locally designated sites of nature conservation interest were identified within the study area.

Terrestrial Habitats

11.3.5 Extended Phase 1 habitat surveys were undertaken for the project in 2013 (Transport Scotland, 2014a and 2014c), to update previous surveys (Transport Scotland, 2011). These results were ground-truthed by further surveys in 2019, and only minor changes from the original Phase 1 data were recorded (e.g. areas of felling within coniferous woodland plantation). This information was then used in the desk-based assessment. Diagram 11.1 shows the proportion of each habitat type or grouping within 150m of the existing A9, based on the validated 2019 survey data. Urban environment, hard surface of roads, exposed rock, and running water, such as rivers and streams, are not included. Habitats within 150m of the existing A9 comprised mainly woodland (68%) and semi-improved and poor semi-improved grassland land (12%) which is predominantly roadside verges. The woodland habitat was primarily broadleaved and mixed woodland (of semi-natural or plantation origin) at 39% of the total habitats, with coniferous plantation 25% of total habitats, and recently-felled woodland as 4%. Only those habitats of authority area importance and above are noted in Table 11.5.

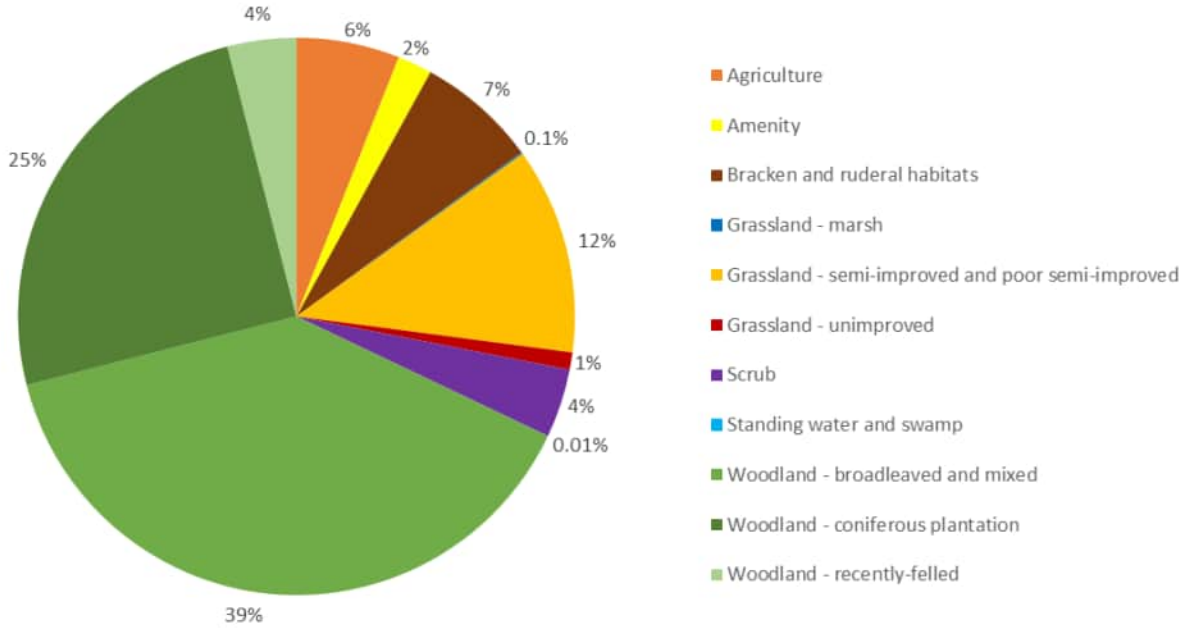

Diagram 11.1: Habitats identified within 150m of the existing A9

11.3.6 The woodland present within the study area is predominantly listed as ancient semi-natural woodlands and LEPO within the AWI sites (SNH, 2008). The study area contains a total of 48 AWI sites: 30 sites are defined as ancient woodland of semi-natural origin; 13 sites of long-established of plantation origin (LEPO sites); and a further five sites were identified as other woodland on 'Roy' woodland sites.

11.3.7 The study area also contains 40 pockets of native woodland categorised as part of the 2006-2012 NWSS (Patterson et al., 2014), with the majority of these sites complementing, or overlapping with, AWI sites. As such, NWSS sites will not be looked at separately for this assessment and will be included with AWI sites and other woodland habitat.

11.3.8 The Phase 1 habitat survey data did not indicate the presence of any habitats listed under Annex 1 of the Habitats Directive which may be sensitive to changes in groundwater flow (groundwater dependent terrestrial ecosystems (GWDTEs)), as discussed in Chapter 9: Geology, Soils and Groundwater. Preliminary assessment of biodiversity resources based on Phase 1 habitat mapping and target notes undertaken prior to this assessment (Transport Scotland, 2014a) had identified eight habitats which were potentially partially supported by groundwater. This list comprised all marsh/marshy grassland and swamp habitats identified on the Phase 1 figures, and any locations where species indicative of wet/moist habitats were recorded in the target notes. However, following site visits undertaken by Jacobs in October 2015, it was considered that the assemblages of species and habitats observed did not constitute GWDTEs as defined in Land Use Planning System Guidance Note 31 (SEPA, 2017), and no further surveys and/or analysis of these habitats were required.

11.3.9 Target notes from the Phase 1 habitat surveys within the study area, undertaken by URS (now AECOM) (Transport Scotland, 2014a), and additional target notes taken during the update 2019 surveys are presented in *Appendix A11.1: Target Notes* and on Figures 11.3-11.6.

Notable Plants

11.3.10 Common juniper (*Juniperus communis*) is listed within the Scottish Biodiversity Strategy (SBS) and associated Scottish Biodiversity List (SBL). A small number of individual bushes of common juniper

plants were recorded at one location within the study area during site surveys (Transport Scotland, 2011).

Aquatic Habitats

11.3.11 Four main watercourses are crossed by the A9 in the study area: Inchewan Burn, the River Braan, Mill Stream and the River Tay. Nine smaller, unnamed watercourses were identified as also being crossed by the A9 in the study area. Both the River Braan and River Tay form part of the River Tay SAC and, to prevent duplication of impacts, will be covered under the River Tay SAC in this assessment (Figures 11.1 and 11.2). The effect of the impacts of the scheme of all 13 watercourses are considered within this assessment.

11.3.12 Suitable freshwater habitats for Atlantic salmon, FWPM, lamprey species, brown/sea trout (*Salmo trutta*) and European eel (*Anguilla anguilla*) were found to be present throughout the River Tay catchment study area (Transport Scotland, 2013, 2014a, 2014c-e). This was corroborated by the targeted walkover surveys undertaken in 2015, 2016 and 2018, which verified high quality habitat in reaches of the River Tay for FWPM, Atlantic salmon and all three lamprey species; and mixed suitability habitat for salmonids and FWPM in the River Braan and Inchewan Burn.

11.3.13 The status of a watercourse is classified in accordance with Annex V of the Water Framework Directive (WFD) (European Commission, 2000) and the SEPA River Basin Management Plan (SEPA, 2021a) data. SEPA monitoring data from 2018 classifies the River Tay and the River Braan as having Good overall status (SEPA, 2021b). It is recognised that the River Braan monitoring point is approximately 6km upstream of the A9 so may not be representative of the conditions at the existing crossing point. However, these data provide context for the assessment and likely condition in the study area.

11.3.14 The Inchewan Burn is a tributary of the River Tay but is not a WFD classified watercourse or a component of the River Tay SAC. A waterfall is present approximately 150m upstream of the existing A9 forming a natural barrier to fish movement that is thought to be impassable under most (if not all) flow conditions. For the purposes of this report, the population of brown trout upstream of this natural barrier are considered to be isolated from the brown trout within the River Tay and its accessible tributaries., including the lower reaches of the Inchewan Burn downstream of the waterfall. A report summary produced for URS (now AECOM) by the TDSFB (2013), following 2013 electrofishing and fish habitat assessment surveys, confirmed the presence of Atlantic salmon spawning habitat within the lower reaches of the burn at this time. Juvenile Atlantic salmon were also recorded throughout the burn downstream of the waterfall. Subsequent site visits undertaken by Jacobs in 2015 and 2018 confirmed the presence of supporting habitat for juvenile and adult Atlantic salmon, brown/sea trout and European eel. A limited amount of spawning habitat was observed during a walkover survey undertaken in 2018 in the section of burn previously identified by the TDSFB as suitable for spawning, however this was deemed sub-optimal due to an overlying layer of silt and algal growth.

11.3.15 Three redd survey visits were undertaken at Inchewan Burn between December 2018 and January 2019 to verify the results of the habitat assessment and record any evidence of Atlantic salmon spawning in the lower reaches of the burn. No signs of spawning activity were observed in the lower reaches of Inchewan Burn that are accessible to migratory fish. It is considered likely that channel substrates have naturally scoured since the TDSFB conducted their electrofishing survey and habitat assessment in 2013, reducing the availability of spawning substrates in the burn. Inchewan Burn is therefore not considered to provide key supporting habitat for the Atlantic salmon population of the River Tay SAC, when considered in the context of the River Tay catchment.

11.3.16 On site visits undertaken by Jacobs in 2015, 2016 and 2018, no suitable habitat for fish species of conservation interest or FWPM was identified at Mill Stream. This is a small watercourse with low flow and was heavily sedimented in the lower reaches close to the River Tay.

Protected Species

11.3.17 Desk-based reviews and survey data identified the presence of the following protected species in the study area:

- Atlantic salmon: evidence of Atlantic salmon recorded throughout the River Tay catchment within the study area (TDSFB, 2009). The River Tay SAC has favourable conservation status for Atlantic salmon (Rivers and Fisheries Trusts of Scotland, 2014).
- River lamprey (*Lampetra fluviatilis*), brook lamprey (*Lampetra planeri*) and sea lamprey (*Petromyzon marinus*): TDSFB indicate that all three species of lamprey are found in the accessible areas of the main stem and larger tributaries of the Tay catchment (TDSFB, 2009). There are records of these species in the study area (NBN, 2021) and suitable habitat was identified in the River Tay catchment during Jacobs site surveys. Site condition monitoring has recorded all three species of lamprey within the River Tay catchment (Watt et al., 2008).
- Trout (brown/sea): there are records of brown/sea trout within the study area (NBN, 2021) and suitable habitat was identified in the River Tay catchment during Jacobs site surveys.
- European eel: evidence was recorded of eels being widespread throughout the River Tay catchment (TDSFB, 2009) and there are historical records, pre-1990, for European eel within the study area (NBN, 2021).
- FWPM: evidence of FWPM were recorded within the River Tay catchment within the study area (NBN, 2021), Transport Scotland (2014a) and SKM (2013)) and during the Jacobs site surveys.
- Otter: evidence of otter was recorded throughout the River Tay catchment within the study area (NBN, 2021) and during Jacobs site surveys, including places of shelter.
- Beaver: evidence of beaver was recorded within the Tayside catchment within the study area since 2006 (Tayside Beaver Study Group, 2015). Additionally, numerous records of beaver activity within the study area are held on NBN (NBN, 2021). Beaver were also recorded as present along the route during the Jacobs site surveys 2015 and in 2018.
- Water vole: watercourses within the study area have the potential to support water vole; however, no records of this species are available after 1960 (NBN, 2021). Water vole are undergoing widespread declines nationally and NatureScot advise the any records prior to 2000 are likely to be unreliable (NatureScot, 2021e).
- Scottish wildcat (*Felis silvestris*): evidence of wildcat was recorded within a10km radius of the study area, most recently from 2008 (NBN, 2021). Priority areas for wildcat conservation are established at Angus Glens, Dulnain, Morvern, Strathavon, Strathbogie and Strathpeffer; however, there are no priority areas within the study area (as defined in Littlewood et al., (2014)).
- Bats: evidence of six of Scotland's nine bat species were recorded within the study area (NBN, 2021). During the Jacobs site surveys 184 trees, 44 buildings and eight structures were recorded with high or moderate roost potential (Collins, 2016) and five buildings and one structure confirmed as roosts.
- Badger: evidence of badger was recorded within the study area (Scottish Badgers, 2020; NBN, 2021) and badger signs and setts were identified during site surveys.
- Pine marten (*Martes martes*): evidence of pine marten was recorded within the study area (NBN, 2021) and this species has an expanding range in Tayside (Croose et al., 2014). Pine marten sightings were also captured on a infra-red trigger camera within the study area (Transport Scotland, 2014a).
- Red squirrel (*Sciurus vulgaris*): evidence of red squirrel was recorded within the survey area NBN (2021) along the A9 and within priority habitats at Craigvinean directly adjacent to the existing A9 to the west of Inver (Poulsom et al., 2005).

- Reptiles: slow worm (*Anguis fragilis*), adder (*Vipera berus*) and common lizard (*Zootoca vivipara*) were recorded in the study area (Transport Scotland, 2014a) and Jacobs site surveys indicated some suitable habitat for these species. Additionally, there are a number of records (NBN, 2021) of slow worm, adder and common lizard within the study area.

11.3.18 A confidential appendix (*Appendix A11.2: Confidential Data on Protected Species*) has been produced for records of badger, bat, beaver, otter and FWPM as their precise locations need to remain confidential. These data will be provided to NatureScot and Transport Scotland for the purposes of review of this assessment only. Bat survey records of confirmed roosts, and sites of high bat roost potential (potential to support large numbers of bats) and moderate bat roost potential (potential to support bats, but unlikely to be a roost of high conservation status) as defined by Collins (2016), as detailed in *Appendix A11.2: Confidential Data on Protected Species*. Sites identified during the 2015, 2018 and 2019 site surveys as presenting low bat roost potential (potential to be used by individual bats opportunistically (Collins, 2016)) have been scoped out of this assessment in order to prioritise moderate and high priority building, structures and trees. However, all low, moderate and high priority building, structures and trees would be assessed at DMRB Stage 3.

11.3.19 FWPM are a species of international importance that are vulnerable to exploitation and are protected under Schedule 5 of the Wildlife and Countryside Act 1981 (as amended) and Annex 2 of the Habitats Directive. They are known to be present within the River Tay, as discussed in *Appendix A11.2: Confidential Data on Protected Species.*

11.3.20 Beaver were recorded as present along the route in 2015 but have subsequently greatly expanded their range as determined from follow-up surveys undertaken in 2018. The 2018 surveys have not covered all minor tributaries, but the data are sufficient for the purposes of this assessment. Additional surveys would be undertaken at DMRB Stage 3.

11.3.21 Red squirrel was recorded as incidental sightings within the study area during site visits. Suitable red squirrel habitat throughout the study area is mostly confined to woodland listed on AWI sites, therefore, calculated loss of AWI sites can be used as a proxy for estimated loss of suitable red squirrel habitat for each proposed route option. Targeted red squirrel surveys would be undertaken at DMRB Stage 3 and red squirrel are not considered to be a differentiator between proposed route options.

11.3.22 Twenty-eight bird species listed on Schedule 1 of the Wildlife and Countryside Act 1981 (as amended) were identified from desk-based assessment (NBN, 2021) within the 10km study area. Consultation information from the Tayside Raptor Study Group (TRSG, 2015) confirmed peregrine (*Falco peregrinus*) breeding at a location within 400m of all of the proposed route options. This record is not deemed to be a differentiator between the proposed route options and, therefore, peregrine and other Schedule 1 bird species will not be discussed further during this assessment and will be covered in detail at DMRB Stage 3.

11.3.23 Habitats suitable for breeding birds, including those presented in Diagram 11.1, such as woodland and scrub, were noted from the extended Phase 1 habitat survey data (Transport Scotland, 2014a). All birds will be assessed in detail at DMRB Stage 3 once the precise locations of habitat loss are known and targeted bird surveys have been completed. Woodland, including woodland listed on AWI sites, is recognised to be suitable breeding bird habitat and, due to the prevalence of this habitat throughout the study area, calculated loss of woodland has been used as a proxy for estimated loss of suitable breeding bird habitat for each proposed route option.

11.3.24 The following biodiversity resources are unlikely to be affected by the proposed route options, based on currently available data, and will not be discussed further:

- Craig Tronach SSSI: nationally protected site under the Wildlife and Countryside Act 1981 (as amended) (Figures 11.1 and 11.2) is located at the southern end of the project, on the northern bank of the River Tay at Dalbeathie, approximately 370m from the proposed route options. The site

is designated for its terrestrial botanical interest, specifically forked spleenwort (*Asplenium septentrionale*), and would not be impacted by any potential changes to the River Tay;

- common juniper: regionally important, listed on the SBL as part of the SBS (Scottish Government, 2015), but are not recorded within an area to be affected by the project;
- water vole: regionally important, protected under Schedule 5 of the Wildlife and Countryside Act 1981 (as amended) but no data to indicate presence in the study area either through desk study or site surveys; and
- Scottish wildcat: internationally important, in decline and protected under the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended), but no data to indicate their presence in the study area and consultation with SNH has ruled out any potential impacts on this species from the options.

Other Species of Ecological Interest

11.3.25 Other species of interest, such as deer, which are not protected for nature conservation reasons or included on the Tayside LBAP but are of concern to the project (due to vehicle collisions and their protection under animal welfare legislation) would be considered at DMRB Stage 3.

11.3.26 Similarly, invasive non-native species (INNS), whilst presenting a threat to biodiversity (Department for Environment, Food & Rural Affairs (Defra), 2015), are not factors in determining the Preferred Route Option at this stage. They would be considered when further detail is available on the land requirements at DMRB Stage 3 (i.e. once the Preferred Route Option is known and land requirements includes areas that may be temporarily utilised/disturbed during construction).

11.3.27 Specialist invertebrate surveys were not undertaken to inform DMRB Stage 2 assessment. Consultation with statutory consultees will be undertaken to determine the scope of any DMRB Stage 3 invertebrate surveys, if required.

Future Baseline

11.3.28 The Perth and Kinross Local Development Plan 2 (PKC, 2019) states that for Dunkeld and Birnam '*the potential for additional development is highly constrained by potential flooding, the surrounding topography, and by various international and national natural and built heritage designations surround the towns*'. Therefore, only small-scale infill residential development is proposed around the towns.

11.3.29 Consultation received from PKC regarding planning applications submitted up to January 2021 revealed proposed works mostly pertaining to extension of dwellings, erection of small-footprint buildings, formation of access tracks in an adjacent field, and installation of a hydro scheme approximately 800m north of the proposed route options. These proposed developments would have minimal land take and, therefore, changes to the habitats and species in the study area would be limited. Therefore, it is considered that they would not result in a change to the baseline assessed. Details of proposed development are described in Volume 1, Part 3 – Environmental Assessment (Chapter 8: Population - Land use).

11.3.30 Forestry plans for crop harvesting and replanting with similar species would not affect the future baseline conditions as, long-term, there would be no change to the habitat type and any potential ancient woodland soils would be retained. Forestry plans that alter the woodland species composition or canopy cover would potentially alter the future baseline within the study area. Management activities which would increase the biodiversity value of the surrounding woodlands include but are not limited to: thinning operations within a coniferous plantation which would increase ground flora diversity; and replanting with native species, including broadleaved species.

11.3.31 Beaver have rapidly expanded throughout the Tay catchment (Campbell-Palmer et al., 2018) and their expansion is likely to continue. With a reduction in availability of suitable habitat due to increased

intra-specific competition, beaver populations would continue to expand up the tributaries of the River Tay within the study area. Beaver are already beginning to populate tributaries such as Inchewan Burn, River Braan, and Mill Stream.

11.3.32 Volume 1, Part 3 – Environmental Assessment (Chapter 11: Road Drainage and the Water Environment) and Volume 1, Part 3 – Environmental Assessment (Chapter 19: Climate) describe in detail likely future scenarios in regard to the effects of the changing climate within the study area. Generally, by 2080 it is projected that winters will be milder and substantially wetter, and summers will be hotter and substantially drier. This would likely lead to greater flood events during winter months. In respect to Biodiversity, these climatic changes would potentially lead to changes in habitat species composition through increasing the proportion of drought tolerant species and decreasing cold tolerant species. Milder, wetter winters may lead to an increased survival rate for animals such as red squirrel, badger and bird species; however, increased flood events may lead to increased wildlife vehicle incidents (WVIs) for otter attempting to cross roads where culverts are flooded or fishing in main rivers is difficult due to higher water levels. Wetter springs may lead to increased mortality of young of deer species and brown hare (*Lepus europaeus*). Drier summers would reduce the availability of small, ephemeral waterbodies for amphibians and insect species. These changes are unlikely to significantly alter the baseline but will be addressed by proposed mitigation at DMRB Stage 3.

11.3.33 In conclusion, the biodiversity baseline for the study area around the proposed route options is unlikely to differ significantly from the existing baseline conditions.

Table 11.5: Summary of Biodiversity Resources Recorded in the Study Area

Biodiversity Resource	Data Sources	Legal/LBAP Status	Importance	Justification
Designated Sites				
River Tay SAC (including the River Tay and the River Braan) (8366 UK0030312) (NN 818 481) (Figures 11.1 and 11.2; *Appendix A11.1 Target Notes*)	SEPA (2019) Scotland's Environment Web Partnership (2018) NatureScot (2021b)	European site under Conservation (Natural Habitats, &c.) Regulations 1994 (as amended). WFD watercourse (in part). Tayside LBAP lists rivers and burns as priority habitats.	International	A 9,461.63ha site, designated as an SAC for its clear-water lakes or lochs, Atlantic salmon, river lamprey, brook lamprey, sea lamprey and otter.
Habitats and Ecosystems				
AWI sites (Figures 11.1 and 11.2)	Patterson et al. (2014) SNH (2008; 2011)	SBL priority habitat (including a variety of semi-natural broadleaved woodland types). One of the priorities of the Tayside LBAP is to protect, restore and enhance woodlands as identified in the NatureScot AWI.	National	Within the study area there are 48 AWI sites and there are 40 pockets of native woodland listed on the NWSS, the majority of which are coincident to, or overlapping with, AWI sites. Ancient woodland or plantation woodland of ancient origin is not readily replaceable if lost and NatureScot has requested that all AWI sites, whether they currently support ancient woodland or not, be treated as protected. The biodiversity value of AWI sites will be assessed at DMRB Stage 3.
Broadleaved and mixed semi-natural woodland and broadleaved plantation woodland (Figures 11.3 to 11.6)	Transport Scotland (2014a) Jacobs 2019 site surveys	Lowland mixed deciduous woodland is listed in the SBL. The Tayside LBAP lists lowland mixed broadleaved woodland and wet woodland.	Regional	These habitats cover approximately 14% of the study area and include 2% of the study area which is not also categorised under the AWI. They can provide important habitat for species such as pine marten and red squirrel. This biodiversity resource only includes habitat not listed on AWI sites. As such, this habitat is deemed to be of recent origin. within the study area, this biodiversity resource represents a negligible fraction of the habitats on a national scale, but it is important on a regional scale.
Coniferous plantation woodland (Figures 11.3 to 11.6)	Transport Scotland (2014a) Jacobs 2019 site surveys	The Tayside LBAP lists planted coniferous woodlands as priority habitats.	Authority area	This habitat covers approximately 58% of the study area and includes 10% of the study area which is not also categorised under the AWI. Plantation woodland is generally of low diversity, with a poorly developed ground flora and shrub layer. It is widespread in this area but can also provide important habitat for species such as pine marten and red squirrel.

Biodiversity Resource	Data Sources	Legal/LBAP Status	Importance	Justification
Inchewan Burn (WF08) (Figures 11.3 to 11.6; *Appendix A11.1 Target Notes*)	Transport Scotland (2014a) Jacobs 2018 and 2019 site surveys	Tayside LBAP lists rivers and burns as priority habitats.	Regional	This watercourse is directly connected to the River Tay SAC, although a waterfall approximately 150m upstream is thought to represent a natural barrier to fish movement under most, if not all flow conditions. The lower reaches are known to have previously supported spawning Atlantic salmon and European eels have also been recorded in the burn. No evidence of spawning was observed in the lower reaches of Inchewan Burn during 2018 and 2019 site surveys and potential spawning habitat was considered to be limited and sub-optimal. Therefore, Inchewan Burn is not considered to provide key supporting habitat for the Atlantic salmon population of the River Tay SAC, when considered in the context of the River Tay catchment.
Mill Stream (WF12) and unnamed watercourses (WF2, WF9, WF13, WF14, WF16) (Figures 11.3 to 11.6; *Appendix A11.1 Target Notes*)	Jacobs 2015 site surveys SEPA (2021b)	The Tayside LBAP lists rivers and burns as priority habitats.	Authority area	Mill Stream and unnamed watercourses are directly connected to the River Tay SAC. The unnamed watercourses do not provide suitable habitat for protected fish species, but they are likely to provide indirect supporting functional habitat through provision of food resource for designated species. Currently no records of fish are available for Mill Stream, and this watercourse is not accessible for migratory salmonids despite designation. There is no suitable habitat for protected species.
Species				
Atlantic salmon	Gilvear et al. (2010) NBN (2021) SKM (2013) SNH (2015a) TDSFB (2009) Transport Scotland (2014a) Jacobs site surveys 2015-2019	Salmon and Freshwater Fisheries (Consolidation) (Scotland) Act 2003. Listed under Schedule 3 of the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended) and Annex II and V of Council Directive 92/43/EEC. A qualifying feature of the River Tay SAC. Listed on the SBL. Tayside LBAP lists Atlantic salmon as an LBAP protected species.	International	Stocks of Atlantic salmon are declining on a global level. The River Tay is considered to be one of the top three rivers in Scotland for Atlantic salmon. The species occurs within the study area and throughout the wider Tay catchment. Spawning habitats have been reported on main rivers and major tributaries.

Biodiversity Resource	Data Sources	Legal/LBAP Status	Importance	Justification
Brook and sea lamprey	NBN (2021) SNH (2015a) Transport Scotland (2011) Watt et al. (2008)	Salmon and Freshwater Fisheries (Consolidation) (Scotland) Act 2003. Listed under Annex II of Council Directive 92/43/EEC. A qualifying feature of the River Tay SAC. Listed on the SBL. Tayside LBAP lists brook and sea lamprey as an LBAP protected species.	International	Sea lamprey and brook lamprey populations are declining across much of their European ranges (Maitland, 2003). Both brook and sea lamprey are known to occur in the wider catchment and within the study area and were reported to have favourable conservation status. Sea lamprey undertake migration between marine and freshwater habitats to complete their lifecycle.
River lamprey	NBN (2021) SNH (2015a) Transport Scotland (2011) Watt et al. (2008)	Salmon and Freshwater Fisheries (Consolidation) (Scotland) Act 2003. Listed under Schedule 3 of the Conservation (Natural Habitats, &c) Regulations 1994 (as amended) and Annex II and V of Council Directive 92/43/EEC. A qualifying feature of the River Tay SAC. Listed on the SBL. Tayside LBAP lists river lamprey as an LBAP protected species.	International	River lamprey populations are declining across its European range (Maitland, 2003). The species is known to occur within the study area and in the wider catchment with a favourable conservation status. River lamprey undertake migrations between freshwater and estuarine habitats.
Brown trout/sea trout	NBN (2021) TDSFB (2009)	Sea trout listed on SBL. Salmon and Freshwater Fisheries (Consolidation) (Scotland) Act 2003. Tayside LBAP lists brown trout as an LBAP protected species.	International	Brown trout/sea trout are widespread throughout the River Tay catchment and are known to occur within the study area. Brown trout is a potential host species for FWPM and can be the preferred salmonid host in some Scottish rivers (Clements et al. 2018). The species, therefore, plays an essential role in the ecosystem that supports the integrity of this critically endangered species.
European eel	Scottish Government (2013) TDSFB (2009) NBN (2021) IUCN Critically Endangered Red List species	European Commission (2007) Council Regulation (1100/2007/EC) Establishing measures for the recovery of the stock of European eel. The Freshwater Fish Conservation (Prohibition on Fishing for Eels) (Scotland) Regulations 2008. Listed on the SBL. Salmon and Freshwater Fisheries (Consolidation) (Scotland) Act 2003	International	European eel populations have undergone major global declines in numbers and are listed as Critically Endangered on IUCN Red List (Jacoby and Gollock, 2014). The species is widespread in the River Tay catchment and is known to occur within the study area.

Biodiversity Resource	Data Sources	Legal/LBAP Status	Importance	Justification
		The Freshwater Fish Conservation (Prohibition on Fishing for Eels) (Scotland) Regulations 2008		
FWPM (*Appendix A11.2 Confidential Data on Protected Species*)	Jacobs 2015 site surveys SNH (2015b) IUCN Critically Endangered Red List species	Schedule 5 of the Wildlife and Countryside Act 1981 (as amended) (WCA). Listed under Annex II of Council Directive 92/43/EEC. Listed on the SBL and as a key species in the Tayside LBAP.	International	FWPM is declining globally, with Scotland being one of its remaining strongholds in north-west Europe. FWPM is listed as Critically Endangered on IUCN Red List (Cuttelod et al., 2011). The species is known to occur in the River Tay and suitable habitat is present in the study area.
Otter (*Appendix A11.2 Confidential Data on Protected Species* and Figures A11.3 and A11.4)	Jacobs 2015 and 2018 site surveys NBN (2021)	European Protected Species (EPS) under the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended). It is a qualifying feature of the River Tay SAC. Tayside LBAP lists otter as an LBAP protected species. Listed as Vulnerable in Scotland in the IUCN Red List for Britain's Terrestrial Mammals (Mathews and Harrower, 2020).	International	The species is at carrying capacity in the study area (Strachan, 2007) (i.e. maximum population size of the species that the environment can sustain indefinitely taking account of food, habitat availability etc.) within the River Tay area and the wider catchment. Ten holts and nine couches were found during 2015 and 2018 surveys (further details are provided in *Appendix A11.2 Confidential Data on Protected Species).* Conservation objectives for otter as a qualifying species of the River Tay SAC include maintaining the population, distribution, and extent of the species, and avoid significant disturbance of the species. All otter within the study area will be associated with the River Tay SAC population.
Beaver (*Appendix A11.2 Confidential Data on Protected Species* and Figures A11.1 and A11.2)	NBN (2021) Tayside Beaver Study Group (2015)	Beaver was granted status as an EPS in May 2019 (NatureScot, 2021f). Listed as Endangered in Scotland in the IUCN Red List for Britain's Terrestrial Mammals (Mathews and Harrower, 2020).	National	The species occupies a restricted distribution across the UK, with disparate populations in southern England, Argyll, and Tayside. The species' expansion throughout the River Tay catchment has been rapid: increasing from approximately 146 individuals in Tayside in 2012 to approximately 433 individuals in 2018 (Campbell-Palmer et al., 2018). The population in Tayside is the largest in Scotland, with 73 territories recorded along the River Tay during the 2017-2018 SNH Survey of the Tayside area beaver population (Campbell-Palmer et al., 2018). Beaver was recorded throughout the study area during 2018 surveys (further details are provided in *Appendix A11.2 Confidential Data on Protected Species*).
Bats (all species) (*Appendix A11.2 Confidential Data on*	Jacobs 2015, 2018 and 2019 site surveys	All UK bat species are EPS under the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended).	Regional	The majority of the species recorded within the study area and 10km surrounding the project are widespread and found throughout Scotland: Daubenton's bat (*Myotis daubentonii*), common pipistrelle

Biodiversity Resource	Data Sources	Legal/LBAP Status	Importance	Justification
Protected Species and Figures A11.5 and A11.6)	NBN (2021) Transport Scotland (2011) Transport Scotland (2014a)	All nine species that occur in Scotland are listed on the SBL. Tayside LBAP lists brown long-eared, Natterer's, Daubenton's and pipistrelle bats as LBAP protected species.		(*Pipistrellus pipistrellus*), soprano pipistrelle (*Pipistrellus pygmaeus*), Natterer's bat (*Myotis nattereri*) and brown long-eared bat (*Plecotus auritus*). Noctule bat (*Nyctalus noctula*) was recorded historically within the wider 10km area but not within the study area, and not within the last 30 years. Noctule bat is not widely distributed within Scotland with only a few records within Perth and Kinross. Noctule bat will, therefore, not be discussed further during this assessment but will be assessed at DMRB Stage 3. Jacobs site surveys undertaken in 2015, 2018 and 2019 indicate 184 trees, 44 buildings and eight structures with the potential to support roosts (classified as per Collins, 2016) within 50m of the proposed route options' footprints. Five buildings and one structure confirmed as roosts are also located within 50m of the proposed route options' footprints.
Badger (*Appendix A11.2 Confidential Data on Protected Species* and Figures A11.1 and A11.2)	Jacobs 2015 and 2018 site surveys. Scottish Badgers Wildlife Vehicle Incident (WVI) data (2019) NBN (2021) Rainey et al. (2009)	Badgers and their setts are protected under the Protection of Badgers Act 1992 as amended by the Wildlife and Natural Environment (Scotland) Act 2011. Tayside LBAP lists badger as an LBAP protected species.	Regional	Badger is listed on Tayside LBAP. Badger was recorded within the study area (including WVIs). Two setts were found during 2015 and 2018 surveys. The species is widespread throughout Scotland, however, estimated densities within Tayside are much lower than other parts of Scotland (Rainey et al., 2009).
Pine marten	Croose et al. (2014) NBN (2021) Transport Scotland (2014a)	Schedule 5 of the WCA. Schedule 3 of the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended). Listed on the SBL. Tayside LBAP lists pine marten as an LBAP protected species.	Regional	Pine marten was recorded within the study area. The species is widespread throughout Scotland and has continued to expand its range throughout Perthshire and Tayside. Listed as Least Concern in Scotland in the IUCN Red List for Britain's Terrestrial Mammals (Mathews and Harrower, 2020).

Biodiversity Resource	Data Sources	Legal/LBAP Status	Importance	Justification
Red squirrel	NBN (2015) Poulsom et al. (2005) Transport Scotland (2014a)	Schedule 5 and 6 of the WCA. Listed on the SBL as a species for which conservation action is needed. Tayside LBAP lists red squirrel as an LBAP protected species. Listed as Near Threatened in Scotland in the IUCN Red List for Britain's Terrestrial Mammals (Mathews and Harrower, 2020).	National	Red squirrels have been recorded along the whole of the existing A9 within the study area. The species is widespread within Scotland although there has been widespread decline in population and range. Priority woodland has been identified within the study area at Craigvinean (NN 983 453) which directly abuts the project (Poulsom et al., 2005).
Birds (all species)	Jacobs 2015 site surveys	All wild birds are protected during breeding activities.	Regional	Habitat supporting breeding birds listed in Bird of Conservation Concern (Eaton, et al. 2015) is in decline across the UK. A list of protected bird species is provided in the Tayside LBAP and several are known to occur in the study area.
Reptiles: adder, slow worm and common lizard	NBN (2021) Transport Scotland (2014a) Jacobs 2015 site surveys	Schedule 5 of the WCA. Nature Conservation (Scotland) Act 2004 Listed on the SBL. Adder listed as a priority species in the Tayside LBAP. Tayside LBAP lists slow worm and common lizard as an LBAP protected species.	Regional	All species recorded within the study area following desk-based assessment and site surveys. All three species are widely distributed throughout Scotland (McInerny and Minting, 2016) and are listed of Least Concern in the IUCN Red List (Isailovic et al., 2009; Cox and Temple, 2009; Agasyan et al., 2010). Five sites were assessed as being suitable reptile habitat within the study area during a site survey in 2018. This is in addition to five sites surveyed in 2015 which were identified as being suitable for reptiles.

11.4 Potential Impacts and Effects

Introduction

11.4.1 Potential impacts and associated effects on biodiversity resources for all proposed route options are as described below. These are impacts and effects that could occur in the absence of mitigation but taking into account embedded mitigation as outlined in DMRB LA 104.

11.4.2 Where a potential effect was assessed as not significant, taking into account the impact categorisation criteria in Table 11.4, it was not considered further in the comparative assessment of the proposed route options. Such potential effects would be of Slight or Neutral significance, and standard construction and design practices would provide appropriate mitigation. For example, temporary removal of breeding bird habitat can be mitigated through appropriate good practice landscape design and site reinstatement.

11.4.3 Where a potential impact is initiated in construction but its effect on a biodiversity resource continues to occur throughout the operational phase (e.g. permanent habitat removal), it is discussed only within operational impacts.

11.4.4 Potential impacts which have associated effects on biodiversity resources of less than local importance are not discussed, as explained in paragraph 11.2.38.

11.4.5 Potential impacts in terms of the land that may be directly required for the proposed route options (i.e. the project 'footprint') takes into consideration areas required for construction.

11.4.6 Records provided by SNH and surveys undertaken by Jacobs in 2015 indicate that FWPM are present within the study area. The potential for effects on FWPM as a result of discharge from drainage works are similar for all proposed route options. The precise location of drainage outfalls would be refined at DMRB Stage 3, when their potential impact would be considered in full as part of the DMRB Stage 3 assessment (see also Section 11.3). As FWPM are not a differentiator for the DMRB Stage 2 proposed route options they are not discussed in Table 11.6.

Construction

11.4.7 Potential construction impacts and effects generally may include, but are not limited to:

- injury or mortality of protected species due to vegetation removal, in-stream works, vehicle movements, and from becoming trapped in uncovered holes and pipes;
- disturbance of protected species from noise, vibration, lighting, movement of vehicles, and increased human activity;
- temporary habitat loss and/or fragmentation due to disturbance activities or temporary removal of habitat for non-permanent aspects of the proposed route options, including working areas and site compounds;
- reduction in fish passage along watercourses where in-channel works and/or dewatering of watercourses are required;
- habitat degradation from sediment release and run-off from construction works, and generation of dust from earth movement, use of haul routes and soil storage; and
- accidental spread of INNS and associated loss of endemic biodiversity resource.

Operation

11.4.8 Potential operational impacts and effects generally may include, but are not limited to:

- Increased injury and mortality of protected species from WVI;
- permanent loss of habitats, such as woodland and other terrestrial habitats, under the footprint of the proposed route options;
- permanent loss and/or shading of aquatic habitats under the footprint of the proposed route options;
- fragmentation of habitats by creating patches of resources, often correlated with habitat loss;
- severance of habitats by preventing a population's access to resources, often an effect of habitat fragmentation;
- pollution from road run-off;
- lighting of habitats leading to disturbance of fish species and nocturnal mammals; and
- loss of fish passage along watercourses where in-channel structures or re-profiling are required.

11.4.9 Information pertaining to drainage features and proposed outfall locations is shown on Figures 10.1-10.4 (Water Features). Drainage outfall locations related to Sustainable Drainage Systems (SuDS) are the same for all proposed route options with the exception of those positioned at ch520 and ch2200 (Option ST2A only), ch900 (Option ST2B, ST2C, ST2D), ch3480 (Route Option ST2C) and ch3460 (Option ST2D).

11.4.10 Drainage issues with respect to the River Tay SAC would be considered in detail at DMRB Stage 3 as the drainage design continues to be developed. This would include a review of the design to refine shape, position and type of treatment proposed. There would also be further consultation with statutory consultees.

11.4.11 The potential loss of habitat within the River Tay SAC includes an area of terrestrial habitat close to the River Braan underbridge, which would be required for construction of abutments and embankments to accommodate road widening between the River Braan and Mill Stream. The majority of the area lost would be existing highway embankments and slopes and is not considered important functional habitat. It is of note that Option ST2C results in a loss of 0.33ha in comparison to 0.25ha for the other three proposed route options. However, it is anticipated that designs would be developed at DMRB Stage 3 to mirror the existing structures, such that they would not extend into the SAC wherever possible and minimise land take. A minor loss of low-quality SAC habitat is therefore predicted for all proposed route options and is not considered a differentiator at DMRB Stage 2.

Impacts Common to All Route Options

11.4.12 Table 11.6 sets out the potential impacts, without mitigation, which are common to all proposed route options.

Table 11.6: Potential Impacts and Effects (Without Mitigation) – Common to All Proposed Route Options

Biodiversity Resource	Importance	Potential Impact	Potential Effect	Level of Impact	Effect Significance Category
Construction					
Designated Sites					
River Tay SAC at: ▪ River Braan and Braan crossing ch4325-4700 ▪ Mill Stream ch4940 ▪ River Braan ch5200-5300 ▪ River Tay ch4700-5000 ▪ River Tay ch7300-7700 ▪ SuDS outfalls	International	Habitat fragmentation due to temporary works at the River Braan crossing.	Short-term fragmentation of habitat used by qualifying species during bridge construction. This effect could occur if undertaken during a sensitive period, although it would be reversible. The effect would be long-term; and would potentially alter the integrity of the biodiversity resource.	Moderate	**Very large**
		De-watering of sections of watercourses to facilitate in-stream construction works for new bridges, and new and extended culverts.	Temporary de-watering may cause mortality of qualifying fish species leading to reductions in viable populations and consequently deviations from the conservation objectives of the SAC. Mortality would be permanent, although any effects at a population level would be short-term and reversible; and would not alter the integrity of the biodiversity resource.	Minor	**Large**
		Run-off from construction related activities.	Pollution of SAC habitats resulting in reduced water quality, changes in pH and increased deposition resulting in modified habitat. Dependent on the magnitude of the pollution event this could result in permanent reductions in the quality of the SAC habitats and on the viability of populations of its qualifying species. In an extreme pollution event this effect would be permanent; and would alter the integrity of the biodiversity resource.	Major	**Very large**
		Noise and vibrations from generic piling associated with structures. General construction noise associated with culvert, bridge and embankment works. Construction lighting.	Disturbance and potential injury or mortality of qualifying interests of the SAC and supporting habitat. This effect would be permanent and would alter the integrity of the biodiversity resource.	Minor	**Large**
		Hydrological changes resulting from in-stream works including construction undertaken on embankments.	Temporary alteration of SAC habitat, such as changes in erosion or deposition, resulting in altered suitability for qualifying interests. Dependent on the magnitude this alteration would have an effect on the SAC and qualifying species populations. This effect would be reversible, long-term and would potentially alter the integrity of the biodiversity resource.	Moderate	**Very large**

Biodiversity Resource	Importance	Potential Impact	Potential Effect	Level of Impact	Effect Significance Category
Habitats and Ecosystems					
AWI sites (throughout the study area; Figures 11.1 and 11.2)	National	Generation of dust from construction activities.	Degradation of habitat leading to changes in health of plants and community compositions. Alterations to species composition could have implications for edge effects protecting the interior of ancient woodland habitat. This effect would be short-term and reversible; and would not alter the key characteristics of the biodiversity resource.	Negligible	Slight
Broadleaved and mixed semi-natural woodland and broadleaved plantation woodland (not listed on the AWI)	Regional	Generation of dust from construction activities.	Degradation of habitat leading to changes in health of plants and community compositions. This effect would be short-term and reversible; and would not alter the key characteristics of the biodiversity resource.	Negligible	Slight
Coniferous plantation woodland (not listed on the AWI)	Authority area	Generation of dust from construction activities.	Degradation of habitat leading to changes in health of plants and community compositions. This effect would be short-term and reversible; and would not alter the key characteristics of the biodiversity resource.	Negligible	Slight
Inchewan Burn (from confluence with River Tay to the natural waterfall 150m upstream) (WF08)	Regional	Run-off from construction works including sediment release.	Smothering of substrates, changes to water quality and modification of submerged habitats. This effect would be reversible and long-term.	Moderate	**Moderate**
		De-watering of a section of the watercourse to facilitate in-stream construction works.	Changes in hydrology leading to a change in functional habitat for species. Inchewan Burn is already modified and has two bridges, so effects would result from increases in length and construction activities associated with extension/replacement. This effect would be short-term and reversible; and would not alter the integrity of the biodiversity resource.	Negligible	Slight
Mill Stream (WF12) and unnamed watercourses (WF2,	Authority area	Run-off from construction works including sediment release.	Smothering of substrates, changes to water quality and modification of submerged habitats. This effect would be reversible, long-term and would potentially alter the integrity of the biodiversity resource.	Moderate	Slight

Biodiversity Resource	Importance	Potential Impact	Potential Effect	Level of Impact	Effect Significance Category
WF9, WF13, WF14, WF16)		De-watering of sections of watercourses to facilitate in-stream construction works for new and extended culverts.	Temporary changes in hydrology leading to a change in functional habitat for species. These watercourses are already modified (culverted) so effects would result from increases in length and construction activities associated with extension/replacement. This effect would be short-term and reversible; and would not alter the integrity of the biodiversity resource.	Negligible	Slight
Species					
Atlantic salmon Brook lamprey Sea lamprey River lamprey Brown trout/sea trout European eel	International	Run-off from construction works including sediment release.	Smothering of substrates leading to modification of submerged habitats. This could lead to a reduction in water quality, potentially causing physiological changes and/or affecting fish gill structures. This effect would be frequent, short-term and reversible; and would potentially alter the integrity of the biodiversity resource. As this effect would be short-term and reversible it is not determined to be of a magnitude that would justify Very Large significance.	Moderate	**Large**
		Construction noise, lighting and vibration.	Noise, vibration and lighting may lead to barrier effects to migrating fish, causing temporary fragmentation of habitat through reduction in fish passage. In extreme circumstances noise and vibration may result in injury or mortality of some fish species. This effect would be frequent, short-term and reversible; and would alter the integrity of the biodiversity resource. As this effect would be short-term and reversible it is not determined to be of a magnitude that would justify Very Large significance.	Moderate	**Large**
		De-watering of sections of watercourses to facilitate in-stream construction works for new bridges, and new and extended culverts.	Temporary de-watering of watercourses may cause mortality of qualifying species. Mortality would be permanent, although the potential effect on the population would be short-term and reversible; and would not alter the integrity of the biodiversity resource.	Negligible	Slight
		In-stream works to facilitate the construction of new bridges, and new and extended culverts.	In-stream works may prevent movement of protected fish species along the watercourse resulting in habitat fragmentation/avoidance of areas. This effect could occur if undertaken during a sensitive period, although it would be reversible. The effect would be long-term and would potentially alter the integrity of the biodiversity resource.	Moderate	**Very large**

Biodiversity Resource	Importance	Potential Impact	Potential Effect	Level of Impact	Effect Significance Category
Otter	International	Construction/extension of culverts.	Fragmentation through temporary loss of habitat (including resting sites), but not at a level that would cause declines in population as the species is widespread in the catchment (based on consultation with the ESG). This impact would be restricted to a small area of suitable habitat within the vicinity of the proposed route options but would potentially result in greater use of less suitable crossing points. This effect would be short-term and reversible; and would potentially alter the integrity of the biodiversity resource. As this effect would be short-term and reversible it is not determined to be of a magnitude that would justify Very Large significance.	Moderate	**Large**
		Construction-related activities including vehicle movement, culvert and watercourse crossing construction, bridge demolition and construction, bank stabilisation works, and creation of excavations – including those for SuDS.	Direct mortality of individuals moving across site from collisions or entrapment in uncovered holes, pipes or machinery. This effect is unlikely to occur in sufficient numbers to affect the wider population and the local population would recover and recruit from this effect. The effect on the population would be long-term and reversible; and would potentially alter the integrity of the biodiversity resource. As this effect would be reversible and likely to occur in small numbers it is not determined to be of a magnitude that would justify Very Large significance.	Moderate	**Large**
		Run-off from construction-related activities including sediment.	Pollution of watercourses resulting in reduced prey availability, leading to a decline in foraging habitat quality. Depending on the nature and magnitude of the pollution event, this effect could be short-term and reversible; and would potentially alter the integrity of the biodiversity resource. As this effect could be short-term and reversible it is not determined to be of a magnitude that would justify Very Large significance.	Moderate	**Large**
		Noise and vibration from piling. General construction noise associated with bridge, embankment and drainage works throughout the proposed route options. Construction lighting.	Disturbance of otter leading to avoidance of key places of shelter and rest. However, the disturbance would not be at a level that would cause declines in the otter population as resting sites and otter are widespread in the catchment. This effect would be medium-term and reversible; and would potentially alter the integrity of the biodiversity resource. As this effect would be medium-term and reversible it is not determined to be of a magnitude that would justify Very Large significance.	Moderate	**Large**

Biodiversity Resource	Importance	Potential Impact	Potential Effect	Level of Impact	Effect Significance Category
Beaver	National	Construction-related activities including vehicle movement, culvert and watercourse crossing construction, bridge demolition and construction, bank stabilisation works, and creation of excavations, including those for SuDS.	Potential direct injury or mortality of individuals moving through the site from collisions, or entrapment in uncovered excavations, pipes or machinery. This effect is unlikely to occur in sufficient numbers to affect the wider population and the local population would recover and recruit from this effect. The effect on the population would be long-term and reversible; and would potentially alter the integrity of the biodiversity resource in the short-term. This effect is not determined to be of a magnitude that would justify Large significance.	Moderate	**Moderate**
		Noise and vibration from piling. General construction noise associated with bridge, embankment and drainage works throughout the route. Construction lighting.	Disturbance of beaver using places of shelter leading to avoidance of key places of shelter and rest. The disturbance would not be at a level that would cause declines in the beaver population as resting sites are not limited within the study area, and beaver are widespread in the catchment. This effect would be medium-term and reversible; and would potentially alter the integrity of the biodiversity resource. This effect is not determined to be of a magnitude that would justify Large significance.	Moderate	**Moderate**
			Disturbance of foraging and commuting beaver leading to avoidance of commuting routes and foraging areas; however, resources for beaver are widespread within the study area. This effect would be short-term and reversible; and would not alter the integrity of the biodiversity resource.	Negligible	Slight
Bats (all species)	Regional	Construction-related activities, including vehicle movement, site/vegetation clearance and building/structure demolition throughout the proposed route options.	Potential direct mortality of individuals during removal of roosting habitat. This effect is unlikely to occur in sufficient numbers to affect the wider populations and the local populations would recover and recruit from this effect. The effect on populations would be long-term and reversible; and would potentially alter the integrity of the biodiversity resource.	Moderate	**Moderate**
		Noise and vibration during construction. Construction lighting.	Temporary disturbance of bats within and adjacent to the footprint of the proposed route options. This could lead to the abandonment of roost sites and increased energy expenditure during roosting periods.	Moderate	**Moderate**

Biodiversity Resource	Importance	Potential Impact	Potential Effect	Level of Impact	Effect Significance Category
			This effect would be short-term and reversible; but would potentially alter the integrity of the biodiversity resource.		
		Light spill and construction-related activities associated with construction/demolition of watercourse crossings (bridges and culverts) and underpasses.	Potential temporary severance of commuting routes leading to increased commuting distances and individuals using less suitable crossing points of the A9. This would potentially lead to an increased risk of mortality of individuals from road-traffic-related incidents. The increased mortality is unlikely to occur in sufficient numbers to affect the wider populations and the local populations would recover and recruit from this effect. The effect on the populations would be short-term and reversible; and would not alter the integrity of the biodiversity resource.	Negligible	Slight
Badger	Regional	Construction-related activities including vehicle movement and creation of excavations.	Direct mortality of individuals moving across site from collisions or entrapment in uncovered excavations, pipes or machinery. This effect is unlikely to occur in sufficient numbers to affect the wider population and the local population would recover and recruit from this effect. The effect on the population would be long-term and reversible; and would potentially alter the integrity of the biodiversity resource.	Moderate	**Moderate**
		Noise, vibrations and light spill associated with construction-related activities.	Temporary disturbance of badgers leading to avoidance of key places of shelter and rest and a change in the distribution of local population(s). This effect has the potential to be long-term if setts are abandoned due to construction-related disturbance; therefore, this effect would be long-term and reversible; but it would not alter the integrity of the biodiversity resource.	Negligible	Slight
		Removal of badger habitat to accommodate construction.	Severance of badger commuting routes leading to habitat fragmentation and temporary loss of habitat. This effect would be short-term and reversible; and would not alter the integrity of the biodiversity resource.	Negligible	Slight
Pine marten	Regional	Construction activity including vehicle movement and vegetation clearance.	Direct mortality of pine marten individuals moving across the site from collisions with site vehicles, vegetation clearance, or entrapment in uncovered holes, pipes or machinery. Loss of habitat (potentially including dens). This effect would be long-term and reversible; and would potentially alter the integrity of the biodiversity resource.	Moderate	**Moderate**

Biodiversity Resource	Importance	Potential Impact	Potential Effect	Level of Impact	Effect Significance Category
		Construction activity, including noise and lighting.	Disturbance of pine marten in dens. Disturbance may also result in avoidance of areas for foraging. This effect would be short-term and reversible; and would not alter the integrity of the biodiversity resource.	Negligible	Slight
Red squirrel	National	Construction activity including vehicle movement and vegetation clearance.	Direct mortality of individuals moving across the site from collisions with site vehicles, vegetation clearance, or entrapment in uncovered holes, pipes or machinery. Loss of habitat (potentially including dreys). This effect is unlikely to occur in sufficient numbers to affect the wider population and the local populations would recover and recruit from this effect. This effect would be long-term and reversible; and would potentially alter the integrity of the biodiversity resource.	Moderate	**Large**
		Construction activity, including noise and lighting.	Disturbance of protected species at places of shelter. Disturbance may also result in avoidance of areas for foraging. This effect would be short-term and reversible; and would not alter the integrity of the biodiversity resource.	Negligible	Slight
Breeding birds	Regional	Construction activity including vehicle movement and vegetation clearance.	Disturbance of nesting birds during the breeding season. This effect is unlikely to occur in sufficient numbers to affect the wider populations and the local populations would recover and recruit from this effect. This effect would be long-term and reversible; and would potentially alter the integrity of the biodiversity resource.	Moderate	**Moderate**
		Construction activity, including noise and lighting.	Disturbance of breeding birds. Disturbance may also result in avoidance of areas for foraging. This effect would be short-term and reversible; and would not alter the integrity of the biodiversity resource.	Negligible	Slight
Reptiles: adder, slow worm and common lizard	Regional	Construction activity, including vehicle movement, vegetation clearance and topsoil stripping.	Direct mortality of individuals present within the site. This effect is unlikely to occur in sufficient numbers to affect the wider populations and the local populations would recover and recruit from this effect. This effect would be long-term and reversible; and would potentially alter the integrity of the biodiversity resource.	Moderate	**Moderate**

Biodiversity Resource	Importance	Potential Impact	Potential Effect	Level of Impact	Effect Significance Category
		General construction noise and vibration.	Disturbance of individuals resulting and some displacement. This effect would be short-term and reversible; and would not alter the integrity of the biodiversity resource.	Negligible	Slight
Operation					
Designated Sites					
River Tay SAC Bridge and bank works on River Tay and River Braan (Figures 11.1 and 11.2)	International	Removal of terrestrial habitats to accommodate scheme footprint, including embankments.	Permanent reduction in the extent of the SAC; however, this area has been determined not to be functionally important terrestrial habitat for qualifying species. In addition, the DMRB Stage 3 design process would minimise SAC land take wherever possible. The effect would be permanent and would not alter the integrity of the biodiversity resource.	Minor	**Large**
		Increase in road run-off due to increase in impervious surfaces.	Increased run-off volumes and contaminants leading to a decrease in water quality for the SAC. As the River Tay is the largest river in the UK by discharge volume (JNCC, 2015b), the increase in run-off would be subject to such large dilution it is considered unlikely to result in any fundamental differences in watercourse characteristics (refer to Volume 1, Part 3 – Environmental Assessment (Chapter 10: Road Drainage and the Water Environment)). This affect would be short-term and reversible; and would not alter the integrity of the biodiversity resource.	Negligible	Slight
		Shading of stream or river bed under footprint of proposed route options.	Change in habitat composition under the proposed route options through increased shading of the stream/river bed; and in some areas, habitat loss is predicted. This effect would be permanent and would not alter the integrity of the biodiversity resource.	Minor	**Large**
Habitats and Ecosystems					
AWI sites (Figures 11.1 and 11.2)	National	Replacement of this habitat with structures within the footprint of the proposed route options (roads and associated embankments).	Permanent reduction in ancient woodland habitat and associated plant and soil biota communities, as well as reduction in availability of this habitat to animal species that rely on it for food, shelter and breeding. This effect would be permanent and would alter the integrity and key characteristics of the biodiversity resource. This effect is determined to be of a magnitude to be of Very Large significance.	Major	**Very Large**

Biodiversity Resource	Importance	Potential Impact	Potential Effect	Level of Impact	Effect Significance Category
Broadleaved and mixed semi-natural woodland and broadleaved plantation woodland (not listed on the AWI)	Regional	Replacement of this habitat with structures within the footprint of the proposed route options (roads and associated embankments).	Permanent reduction in availability of this habitat and associated plant and soil biota communities, as well as reduction in availability of this habitat to animal species that rely on it for food, shelter and breeding. Derogation from targets set out in the SBS. This effect would be permanent and would alter the integrity and key characteristics of the biodiversity resource.	Major	**Large**
Coniferous plantation woodland (not listed on the AWI)	Authority area	Replacement of this habitat with structures within the footprint of the proposed route options (roads and associated embankments).	Permanent reduction in availability of this habitat and associated plant and soil biota communities, as well as reduction in availability of this habitat to animal species that rely on it for food, shelter and breeding. Derogation from targets set out in the SBS. This effect would be permanent and would alter the integrity and key characteristics of the biodiversity resource.	Major	**Moderate**
Mill Stream (WF12) and unnamed watercourses (WF2, WF9, WF14, WF16)	Authority area	New and extended culverts causing permanent loss of habitat.	Reduced availability or fragmentation of habitat for aquatic fauna and flora. This effect would be permanent and would alter the integrity of the biodiversity resource.	Major	**Moderate**
		Increase in road run-off and changes in hydrology due to increase in impervious surfaces.	Increased run-off volumes and contaminants leading to decreased water quality and a reduction in biodiversity. This effect would be long-term and reversible; and would alter the integrity of the biodiversity resource.	Moderate	Slight
Species					
Atlantic salmon Brook lamprey Sea lamprey River lamprey Brown/sea trout European eel	International	Pollution from road run-off and drainage discharge.	Increased run-off volumes and contaminants in areas of key habitat leading to decreased water quality and altered habitat (e.g. habitat utilised for spawning). Effects of operational drainage on water quality are assessed as being not significant (Chapter 10: Road Drainage and the Water Environment) and the proportion of the populations affected is likely to be low. This effect would be reversible, long-term and would potentially alter the integrity of the biodiversity resource. This effect is not determined to be of a magnitude to be of Very Large significance due to the high dilution factor of the River Tay.	Moderate	**Large**
		Changes in hydrology as a result of altered crossing structures and outfalls.	Alteration of habitat. Dependent on the magnitude of hydrological change this could be a permanent effect, however, it is unlikely to have an effect at a population level for salmonids, lamprey species and European eel and, therefore, would not alter the integrity of the biodiversity resource.	Minor	**Large**

Biodiversity Resource	Importance	Potential Impact	Potential Effect	Level of Impact	Effect Significance Category
		Shading from structures and disturbance due to operational lighting.	Potential for habitat fragmentation through shading from structures. Potential for disturbance and habitat fragmentation through operational lighting. This effect is predicted to be permanent, however, it is unlikely to have an effect at a population level for salmonids, lamprey species and European eel and, therefore, would not alter the integrity of the biodiversity resource. This effect is not determined to be of a magnitude to be of Large significance.	Minor	**Moderate**
Otter	International	Increased road footprint including new carriageway, junctions and access tracks within the vicinity of watercourses.	Increased risk of direct mortality of individuals through road-traffic-related incidents due to the widened carriageway. This effect is unlikely to occur in sufficient numbers to affect the wider population and the local population would recruit and recover from individual direct mortality of otters. However, the increased risk associated with individuals attempting to cross the road would be permanent. This effect would be permanent and would not alter the integrity of the biodiversity resource. As this effect would not alter the integrity of the biodiversity resource is not determined to be of a magnitude that would justify Large significance.	Minor	**Moderate**
		Replacement of habitat with within the footprint of the proposed route options (bridges, road, associated cutting/embankments, bank stabilisation and retaining walls)	Reduction of foraging and terrestrial sheltering habitat with potential for destruction of holts/couches. Current survey results show that places of shelter for otter are due to be lost to the proposed route options. Suitable alternative habitat for otter is widespread throughout the study area. This effect would be permanent and would not alter the integrity of the biodiversity resource. This effect is not determined to be of a magnitude that would justify Large significance.	Minor	**Moderate**
		Increased road run-off associated with increased road traffic	Pollution of watercourses resulting in decreased water quality causing a reduction in fitness of individuals and a reduction in prey resource. This effect is not likely to affect the conservation status of otter populations. This effect would be permanent and would not alter the integrity of the biodiversity resource. This effect is not determined to be of a magnitude that would justify Large significance.	Minor	**Moderate**
Beaver	National	Increased road footprint including new carriageway, junctions and access tracks within the vicinity of watercourses.	Increased risk of direct mortality of individuals through road-traffic-related incidents due to the widened carriageway. This effect is unlikely to occur in sufficient numbers to affect the wider population and the local population would recruit and recover from individual direct mortality of beavers. However, the increased risk associated with individuals attempting to cross the road would be permanent.	Minor	**Moderate**

Biodiversity Resource	Importance	Potential Impact	Potential Effect	Level of Impact	Effect Significance Category
			This effect would be permanent and would not alter the integrity of the biodiversity resource		
		Replacement of bankside habitat with structures within the footprint of the proposed route options (culverts, bank protection and embankments).	Reduction of foraging and burrow/lodge habitat with potential for destruction of structures/burrows. Resources for beaver are widespread within the study area. This effect would be permanent and would not alter the integrity of the biodiversity resource. As this effect would not alter the integrity of the biodiversity resource it is not determined to be of a magnitude that would justify Moderate significance.	Minor	Slight
		Increased road run-off reaching watercourses, associated with increased road traffic.	Pollution of watercourses resulting in decreased water quality causing a reduction in fitness of individuals. This effect is not likely to affect the conservation status of beaver populations. This effect would be permanent and would not alter the integrity of the biodiversity resource.	Minor	Slight
Bats (all species)	Regional	Destruction of confirmed/potential roosts to accommodate replacement of habitat with structures within the footprint of the proposed route options (bridges, road and associated cuttings/embankments).	Permanent loss of three confirmed roosts and 37 sites (building, structures and trees) with high or moderate bat roosting potential. This could result in the permanent loss of maternity roosting habitat. This effect would be permanent and would potentially alter the integrity of the biodiversity resource.	Major	**Large**
		Disturbance to building and structure roost sites and adjacent woodland habitats (potentially used for roosting, foraging and commuting) by operational lighting and increased road traffic noise and vibration.	Permanent disturbance of three confirmed roosts and 133 sites (building, structures and trees) of high or moderate roost potential adjacent to the footprint of the proposed route options. This could lead to the abandonment of roost sites and increased energy expenditure during roosting periods. This effect would be permanent and would potentially alter the integrity of the biodiversity resource	Major	**Large**
		Modification/replacement of structures within the footprint of the proposed route options (bridges, road and associated cutting/embankments and retaining walls).	Severance of commuting routes leading to increased commuting distances and individuals using less suitable crossing points of the A9. This would lead to a permanent increased risk of mortality of individuals from road-traffic-related incidents. The effect on the populations would be permanent and would potentially alter the integrity of the biodiversity resource.	Major	**Large**

Biodiversity Resource	Importance	Potential Impact	Potential Effect	Level of Impact	Effect Significance Category
		Replacement of habitat with structures within the footprint of the proposed route options (bridges, and road and associated cutting/embankments).	Reduction in availability of foraging habitat. Suitable alternative foraging habitat is widespread throughout the study area. This effect would be permanent and would not alter the integrity of the biodiversity resource.	Minor	Slight
Badger	Regional	Increased road footprint including new carriageway, junctions and access tracks.	Increased risk of direct mortality of individuals through road-traffic-related incidents due to the widened carriageway. This effect is unlikely to occur in sufficient numbers to affect the wider population. The local population would recover and recruit from this effect, but as badger presence is limited along the proposed route options, loss of individuals may cause social groups to relocate. The increased risk associated with individuals attempting to cross the road would be permanent. This effect would be permanent and would potentially alter the integrity of the biodiversity resource.	Major	**Large**
		Replacement of habitat with structures within the footprint of the proposed route options (road and associated cuttings/embankments).	Reduction in availability of foraging habitat. Suitable alternative foraging habitat is common throughout the study area. This effect would be permanent and would not alter the integrity of the biodiversity resource.	Minor	Slight
Pine marten	Regional	Replacement of habitat with structures within the footprint of the proposed route options (road and associated cuttings/embankments).	Destruction of any dens and permanent reduction in availability of this habitat to pine marten that rely on it for food, shelter and breeding. Suitable alternative habitat for pine marten is widespread throughout the study area; and, as pine marten have large home ranges, the proportion of the home ranges of the local pine marten populations effected would likely be limited. However, loss of important habitat within home ranges may occur. Permanent reduction in suitable nesting habitat which could result in reduced breeding success in the short-term and a permanent reduction in the carrying capacity of the local area. This effect would be permanent and would potentially alter the integrity of the biodiversity resource. This effect is not determined to be of a magnitude that would justify Large significance.	Major	**Moderate**
		Increased road footprint including new carriageway, junctions and access tracks.	Increased risk of direct mortality of individuals through road-traffic-related incidents due to the widened carriageway.	Minor	Slight

Biodiversity Resource	Importance	Potential Impact	Potential Effect	Level of Impact	Effect Significance Category
			This effect is unlikely to occur in sufficient numbers to affect the wider populations. The local populations would recover and recruit from this effect. The increased risk associated with individuals attempting to cross the road would be permanent. This effect would be permanent; and would not alter the integrity of the biodiversity resource.		
Red squirrel	National	Replacement of habitat with structures within the footprint of the proposed route options (road and associated cuttings/embankments).	Destruction of any dreys and permanent reduction in availability of this habitat to red squirrel that rely on it for food, shelter and breeding. Suitable alternative habitat for red squirrel is widespread throughout the study area. However, red squirrel home ranges are small, and the amount of woodland lost throughout the proposed route options could greatly affect the home ranges of the local population. This effect would be permanent and would potentially alter the integrity of the biodiversity resource. However, well connected suitable habitat is widespread throughout the survey area this effect it is not determined to be of a magnitude that would justify Very Large significance.	Major	**Large**
		Increased road footprint including new carriageway, junctions and access tracks.	Increased risk of direct mortality of individuals through road-traffic-related incidents due to the widened carriageway. This effect is unlikely to occur in sufficient numbers to affect the wider population. The local populations would recover and recruit from this effect. The increased risk associated with individuals attempting to cross the road would be permanent. This effect would be permanent and would not alter the integrity of biodiversity resource.	Minor	Slight
Breeding birds	Regional	Replacement of habitat with structures within the footprint of the proposed route options (road and associated cuttings/embankments).	Permanent reduction in suitable nesting habitat which could result in reduced breeding success in the short-term and a permanent reduction in the carrying capacity of the local area. This effect would be permanent and would potentially alter the integrity of the biodiversity resource. This effect is not determined to be of a magnitude that would justify Large significance.	Major	**Moderate**
		Increased road footprint including new carriageway, junctions and access tracks.	Increased risk of direct mortality of individuals through road-traffic-related incidents due to the widened carriageway. This effect is unlikely to occur in sufficient numbers to affect the wider populations. The local populations would recover and recruit from this effect. The increased risk associated with individuals attempting to cross the road would be permanent. This effect would be permanent and would not alter the integrity of the biodiversity resource.	Minor	Slight

Biodiversity Resource	Importance	Potential Impact	Potential Effect	Level of Impact	Effect Significance Category
Reptiles: adder, slow worm, common lizard	Regional	Increased road footprint.	Mortality of individuals through road-traffic-related incidents. This effect is unlikely to occur in sufficient numbers to affect the wider populations. The local populations would recover and recruit from this effect. The increased risk associated with individuals attempting to cross the road would be permanent. This effect would be permanent and would not alter the integrity of the biodiversity resource.	Minor	Slight
		Replacement of reptile habitats with structures within the footprint of the proposed route options (road and associated cuttings/embankments).	Reduction of foraging and refugia habitat for reptiles, and loss of hibernacula. This effect would be permanent and would potentially alter the integrity of the biodiversity resource.	Major	**Large**

Impacts and Effects Specific to Proposed Route Options

Impacts and Effects Specific to Option ST2A

Construction

11.4.13 A cut and cover tunnel is proposed between ch2150 and ch3775. To enable crossing of the Inchewan Burn, the burn is required to be lowered by approximately 8m, passing beneath the proposed tunnel in a culvert. During construction, a section of Inchewan Burn would be diverted into a temporary culvert running alongside the existing channel.

11.4.14 The construction period for the works around the Inchewan Burn is proposed to last approximately 12-18 months. However, the Inchewan Burn would be impassable to otter at the culvert until the cut and cover tunnel is operational and the temporary A9 is removed, thereby restoring connectivity over the cut and cover tunnel. This would potentially be 4.5-5 years and may prevent access to any feeding resources in this area. However, otter field signs and infra-red trigger camera monitoring recorded within Ladywell Plantation indicate that the upper reaches of Inchewan Burn are likely accessible from the River Braan and therefore fragmentation of Inchewan Burn would not inhibit otters from accessing the upper reaches. In addition, low numbers of otters were recorded commuting along Inchewan Burn and no evidence suggestive of breeding or breeding behaviour was recorded. As such, no construction related potential effects additional to those reported for all proposed route options are anticipated for otter in regard to Option ST2A.

11.4.15 Atlantic salmon, brown trout and European eel have been recorded in Inchewan Burn, which contains mixed habitat with a good supporting habitat for juvenile Atlantic salmon and brown/sea trout. The utilisation of available habitat under the immediate footprint of Option ST2A and further upstream would be disrupted during the construction phase. A reduction in available juvenile habitat within the Inchewan Burn due to construction related disturbance and the channel diversion has the potential to cause a Moderate level impact on an Internationally important biodiversity resource resulting in the potential for an effect of Very Large significance.

11.4.16 For Option ST2A, there is potential for construction related impacts, such as disturbance from noise and vibration (refer to Volume 1, Part 3 – Environmental Assessment (Chapter 16: Noise and Vibration)), to be greater than those for the other proposed route options. This is a result of the requirement for more extensive construction related activities to create the cut and cover tunnel. The additional construction related activities include continuous bored piling for 12-18 months to create the tunnel walls, transport of concrete and other materials to a batching plant at ch2100 and rerouting of the Inchewan Burn. However, potential construction impacts would be limited as the cut and cover tunnel is located along the existing A9 corridor, between the Highland Main Line railway and Birnam, with minimal suitable habitat for protected species along its length.

Operation

11.4.17 The culverting and regrading of Inchewan Burn would result in permanent geomorphological changes and prevent fish passage to habitat upstream. Although it would remain accessible, habitat currently utilised by Atlantic salmon, brown/sea trout and European eel downstream of the proposed culvert would be altered. In these regraded lower reaches, it is expected that suitable habitat for juvenile Atlantic salmon, brown/sea trout and European eel would re-establish under the implementation of an appropriate channel design. Spawning potential within the burn is restricted to the section downstream of Perth Road. Surveys recorded very limited and sub-optimal spawning habitat for salmonids in this reach of the burn, with only small areas of suitable habitat present and overlying silt and algae covering the substrates. Walkover surveys to identify spawning redds were undertaken in January 2019 and no evidence of salmonid spawning in the burn was recorded. Although spawning habitat was limited, habitat

suitable for juvenile salmonids was observed in the burn. The reduction in accessible juvenile habitat available within the burn has the potential to cause a minor level impact on an Internationally important biodiversity resource resulting in the potential for an effect of Large significance.

11.4.18 Permanent habitat loss of AWI sites associated with Option ST2A would potentially extend to approximately 20.58ha. This potential effect would be permanent and would alter the integrity of the biodiversity resource. There would, therefore, be a Moderate level of impact on a Nationally important biodiversity resource resulting in the potential for an effect of Very Large significance.

11.4.19 In addition to losing the known and potential bat roosts common to all proposed route options (Table 11.6), Option ST2A would result in the permanent loss of an additional 12 trees assessed as having either high or moderate bat roosting potential (*Appendix A11.2: Confidential Data on Protected Species* and Figure A11.5). Similarly, in addition to the known and potential bat roosts potentially impacted by operational disturbance by all proposed route options (Table 11.6), Option ST2A would result in the potential disturbance of a further 29 sites (comprising of building and trees) (*Appendix A11.2: Confidential Data on Protected Species* and Figure A11.5). Both of these are predicted to cause a potential Major level of impact on a Regionally important biodiversity resource, resulting in the potential for an effect of Large significance.

11.4.20 Creation of the cut and cover tunnel would involve the removal of the existing A9 carriageway potentially leading to increases in habitat connectivity for birds, bats and reptiles that would be able to access the top of the cut and cover tunnel.

Impacts and Effects Specific to Option ST2B

Construction

11.4.21 To enable the lowered A9 carriageway to cross the Inchewan Burn, it would be necessary to lower the burn between ch3440 and ch3480 by approximately 5.8m, with the burn passing beneath the lowered A9 carriageway. During construction, a section of Inchewan Burn would be diverted into a temporary culvert running alongside the existing channel.

11.4.22 The construction period for the works around the Inchewan Burn is proposed to last approximately 12-18 months, during which the Inchewan Burn would be impassable to otter at the culvert and may prevent access to feeding resources in this area. However, otter field signs (including prints, spraints and feeding remains) and infra-red trigger camera monitoring recorded within Ladywell Plantation indicates that the upper reaches of Inchewan Burn are likely accessible from the River Braan and therefore fragmentation of Inchewan Burn would not inhibit otters from accessing the upper reaches. In addition, low numbers of otters were recorded commuting along Inchewan Burn and no evidence suggestive of breeding or breeding behaviour was recorded. Further details are provided in *Appendix A11.2 (Confidential Data on Protected Species).* As such, no potential construction related effects additional to those reported for all proposed route options are anticipated for otter with regards to Option ST2B.

11.4.23 Atlantic salmon, brown trout and European eel have been recorded in Inchewan Burn, which contains mixed habitat with a large quantity of good supporting habitat for juvenile Atlantic salmon and brown/sea trout. The utilisation of available habitat under the immediate footprint of Option ST2B and further upstream and downstream would be disrupted during the construction phase. A reduction in available juvenile habitat within the Inchewan Burn due to construction related disturbance has the potential to cause a Moderate level impact on an Internationally important biodiversity resource resulting in the potential for an effect of Very Large significance.

Operation

11.4.24 The culverting and regrading of Inchewan Burn would result in permanent geomorphological changes and prevent fish passage to habitat upstream of the proposed culvert. Although it would remain accessible, habitat currently utilised by Atlantic salmon, brown/sea trout and European eels under the footprint of Option STB, and along the regraded length of the channel downstream, would be altered. In the regraded lower reaches, it is expected that suitable habitat for juvenile Atlantic salmon, brown/sea trout and European eel would re-establish under the implementation of an appropriate channel design. Spawning potential within the burn is restricted to the section downstream of Perth Road. Surveys recorded very limited and sub-optimal spawning habitat for salmonids in this reach of the burn, with only small areas of suitable habitat present and overlying silt and algae covering the substrates. Walkover surveys to identify spawning redds were undertaken in January 2019 and no evidence of salmonid spawning in the burn was recorded. Although spawning habitat was limited, habitat suitable for juvenile salmonids was observed in the burn. The reduction in accessible juvenile habitat available within the burn would have the potential cause a Minor level impact on an Internationally important biodiversity resource resulting in the potential for an effect of Large significance.

11.4.25 The culvert for the realigned Inchewan Burn requires a drop structure impassable to otter. However, the upper reaches of Inchewan Burn are likely accessible from the River Braan through Ladywell Plantation and therefore otter would not be inhibited from accessing upstream of the culvert drop structure. As such, no potential operation related impacts or effects additional to those reported for all proposed route options are anticipated for otter with regards to Option ST2B.

11.4.26 Permanent habitat loss of AWI sites associated with Option ST2B would potentially extend to approximately 17.08ha. This potential effect would be permanent and would alter the integrity of the biodiversity resource. There would, therefore, be a Major level of impact on a Nationally important biodiversity resource resulting in the potential for an effect of Very Large significance.

11.4.27 In addition to losing the known and potential bat roosts common to all proposed route options (Table 11.6), Option ST2B would result in the permeant loss of an additional 13 trees assessed as having either high or moderate bat roosting potential (*Appendix A11.2: Confidential Data on Protected Species* and Figure A11.5). Similarly, in addition to the known and potential bat roosts potentially impacted by operational disturbance by all proposed route options (Table 11.6), Option ST2B would result in the potential disturbance of a further 29 sites (comprising of building and trees) (*Appendix A11.2: Confidential Data on Protected Species* and Figure A11.5). Both of these are predicted to cause a potential Major level of impact on a Regionally important biodiversity resource, resulting in the potential for an effect of Large significance.

Impacts and Effects Specific to Option ST2C

Construction

11.4.28 No potential impacts or effects during construction additional to those reported for all proposed route options are anticipated with regards to this proposed route option.

Operation

11.4.29 Permanent habitat loss of AWI sites associated with Option ST2C would potentially extend to approximately 18.12ha. This effect would be permanent and would alter the integrity of the biodiversity resource. There would, therefore, be a Moderate level of impact on a Nationally important biodiversity resource resulting in the potential for an effect of Very Large significance.

11.4.30 In addition to losing the known and potential bat roosts common to all proposed route options (Table 11.6), Option ST2C would result in the permeant loss of an additional 12 trees assessed as having either

high or moderate bat roosting potential (*Appendix A11.2: Confidential Data on Protected Species* and Figure A11.6). Similarly, in addition to the known and potential bat roosts potentially impacted by operational disturbance by all proposed route options (Table 11.6), Option ST2C would result in the potential disturbance of a further 31 sites (comprising of building and trees) (*Appendix A11.2: Confidential Data on Protected Species* and Figure A11.6). Both of these are predicted to cause a potential Major level of impact on a Regionally important biodiversity resource, resulting in the potential for an effect of Large significance.

Impacts and Effects Specific to Option ST2D

Construction

11.4.31 No potential impacts during construction additional to those reported for all proposed route options are anticipated with regards to this proposed route option.

Operation

11.4.32 Permanent habitat loss of AWI sites associated with Option ST2D would potentially extend to approximately 16.56ha. This effect would be permanent and would alter the integrity of the biodiversity resource. There would, therefore, be a potential Moderate level of impact on a Nationally important biodiversity resource resulting in the potential for an effect of Very Large significance.

11.4.33 In addition to losing the known and potential bat roosts common to all proposed route options (Table 11.6), Option ST2D would result in the permeant loss of an additional six trees assessed as having either high or moderate bat roosting potential (*Appendix A11.2: Confidential Data on Protected Species* and Figure A11.6). Similarly, in addition to the known and potential bat roosts potentially impacted by operational disturbance by all proposed route options (Table 11.6), Option ST2D would result in the potential disturbance of a further 26 sites (comprising of building and trees) (*Appendix A11.2: Confidential Data on Protected Species* and Figure A11.6). Both of these are predicted to cause a potential Major level of impact on a Regionally important biodiversity resource, resulting in the potential for an effect of Large significance.

Securing Positive Effect for Biodiversity

11.4.34 The horizontal route alignments for the proposed route options are roughly equal; therefore, the majority of the biodiversity losses would be approximately the same. Key differences between the proposed route options for habitat loss are restricted to the Murthly Estate Underbridge/Overbridge, Birnam Junction, and Dunkeld Junction. Permanent habitat loss listed on AWI sites is being used within this assessment as a proxy for biodiversity loss to compare proposed route options. Option ST2A is potentially losing the most habitat listed on AWI sites of 20.58ha, followed by Option ST2C (18.12ha) and Option ST2B (17.08ha). Option ST2D is potentially losing the least amount of habitat listed on AWI sites, of 16.56ha. Therefore, it is assumed that Option ST2A would potentially result in the largest loss of biodiversity and Option ST2D would potentially result in the lowest loss of biodiversity. Therefore, securing positive effects for biodiversity at DMRB Stage 3 is potentially likely to be easier with Option ST2D.

11.5 Potential Mitigation

11.5.1 Proposed mitigation, including embedded mitigation, would follow a hierarchical approach to be adopted, where possible, in the following order (DMRB LA 104; CIEEM, 2018; SNH, 2018):

- avoid or prevent adverse impacts in the first instance;
- where avoidance is not possible, reduce the adverse impacts and effects through mitigation;

- where residual significant effects remain, compensation measures to offset the adverse effects at a site-specific level may be required (such as for irreplaceable habitats including ancient woodland); and
- enhancement should be sought to provide net benefits for biodiversity resources above avoidance, mitigation and compensation.

11.5.2 It is expected that the majority of impacts assessed as not leading to significant effects would be mitigated through the application of standard mitigation commitments and best working practice (e.g. mitigation of potential pollution impacts through adherence to standard best practice and guidelines, such as Guidance for Pollution Prevention (GPPs) (NetRegs, 2021).

11.5.3 Potential significant effects on biodiversity resources, as shown in Section 11.4 (Potential Impacts and Effects), and including run-off from construction related activities, are expected to be mitigated through a combination of best practice mitigation methods and mitigation targeted to specific locations.

11.5.4 This section includes mitigation that avoids or reduces potential impacts and effects on important biodiversity resources, such that they would not be considered significant under the terms of the EIA Regulations.

11.5.5 Mitigation measures, including a monitoring strategy where appropriate, would be developed as part of the iterative design development and more detailed assessment at DMRB Stage 3. Potential measures are identified in this section and are applicable to all proposed route options unless specified otherwise.

Construction

11.5.6 Potential for disturbance (noise, vibration and lighting) to qualifying species of the River Tay SAC could be reduced for all proposed route options by measures such as:

- careful routing of site access routes and creating exclusion zones in sensitive areas;
- retention of vegetated banks;
- use of directional lighting; and
- use of noise and vibration management plans (including the avoidance of sensitive times and soft starts and lower vibration methods) to minimise negative effects on qualifying species.

11.5.7 For all proposed route options, good construction practice would avoid or reduce the potential effects of sediment release, spills and run-off affecting:

- water quality, submerged habitat quality and associated long-term changes in populations of qualifying species of the River Tay SAC; and
- potential direct mortality of aquatic species, and reductions in quality of aquatic habitats.

11.5.8 Such requirements could be set out in a Contractor's Construction Environmental Management Plan (CEMP) which would outline how construction of the project would avoid or reduce effects on the environment and surrounding area. The following avoidance/mitigation measures (above those discussed in this section) could be included in the CEMP where applicable:

- an Ecological Clerk of Works (ECoW) to ensure all measures within the CEMP are adhered to during construction;
- site compounds and access routes not to be located within or adjacent to habitats to be retained or habitats of high conservation value;
- the location of material storage, generators and lighting considered to avoid or reduce disturbance to protected species and pollution of important habitats, including designated sites;

- vegetation clearance undertaken outwith bird nesting season (1 March to 31 August), or where this is not feasible, implementation of measures to avoid harm to birds and nests and undertaken under the supervision of an ECoW;
- INNS identified prior to works and removed/managed appropriately to prevent their spread;
- monitoring protected species and habitats during construction; and
- and mitigation monitoring during construction, as required.

11.5.9 Disturbance to badger, beaver, fish, FWPM, otters, reptiles, pine marten and roosting bats could be reduced through:

- the provision of appropriate protection systems and/or construction exclusion zones;
- use of noise management plans (avoiding sensitive times) to minimise negative effects on fish species (Atlantic salmon, all three lamprey species, and European eel);
- soft start techniques for noisy activities such as piling procedures; and
- limits on working during hours of darkness where feasible; however, where it is required, consultation with NatureScot will be undertaken in regard to mitigation, including the provision of directional construction lighting.

11.5.10 The risk of mortality to species such as otter, badger, beaver, red squirrel and pine marten when travelling through construction areas could be avoided or reduced by provision of:

- mammal-resistant fencing to establish exclusion zones to mitigate for direct mortality caused by construction related activities;
- maintenance of connectivity and commuting routes, where practical (e.g. culverts/underpasses);
- following the conditions of any granted licence; and
- following standard best practice site management, e.g. covering holes and pipes or means of escape from uncovered excavations.

11.5.11 The risk of mortality to species such fish when travelling through watercourses in the construction areas could be avoided or reduced by provision of:

- avoiding noisy activities during sensitive periods.

11.5.12 The risk of mortality to reptiles in construction areas could be avoided or reduced by:

- phased stripping of vegetation under supervision and the removal of any reptiles present to pre-designated habitat areas; and
- if appropriate and feasible, reptile-proof fencing in areas of large populations.

11.5.13 During construction, trees, including in areas of woodland listed on the AWI sites, should be protected in line with guidelines provided in 'BS 5837 Trees in relation to Construction' (British Standards Institution, 2012). This includes the following:

- establishment of Root Protection Areas (RPA);
- protective fencing would be erected around the RPA to reduce risks associated with vehicles trafficking over root systems or beneath canopies;
- selective removal of lower branches of trees to reduce risk of accidental damage by construction plant and vehicles;
- measure to prevent soil compaction; and
- maintain vegetation buffer strips (where practicable).

11.5.14 Greater construction related potential impacts have been identified for Option ST2A, and to a lesser extent Option ST2B, due to the requirement for more extensive construction related activities required to construct the cut and cover tunnel. Adherence to the CEMP and construction good practice guidance is likely to be appropriate to mitigate for additional construction related activities specific to Option ST2A.

11.5.15 A Controlled Activities Regulations (CAR) licence would be required for in-channel works and culvert installation for, including the temporary diversion of, Inchewan Burn at ch3460 for Options ST2A and ST2B.

11.5.16 Potential fragmentation (physical or functional) of aquatic habitats through in-channel works and culvert installation (all proposed route options), the temporary diversion of Inchewan Burn (for Options ST2A and ST2B), and the resultant loss of populations of aquatic species, could be reduced through:

- avoiding sensitive time periods for protected species such as fish spawning and migration periods;
- the use of low vibration methods of construction;
- works being carried out in accordance with SEPA's Engineering in the Water Environment: Good Practice Guide - River Crossings (2010) to ensure fish passage through culverts is maintained during construction; and
- relocation of fish present within the culvert extension/installation footprints or de-watered stream channels.

11.5.17 It is determined that Options ST2A and ST2B would require additional construction related mitigation measures in comparison to Options ST2C and ST2D. This is primarily due to the requirement to mitigate for construction activities for lowering and re-routing the Inchewan Burn.

Operation

11.5.18 Potential habitat loss (under the footprint of the proposed route options and through shading of watercourses at crossings e.g. from additional infrastructure in the watercourse) for the River Tay and its qualifying species (all options) could be reduced or compensated through:

- enhancement of existing habitat with the aim of increasing the amount of supporting habitat available for qualifying species; and
- adherence to the design principles set out in the programme-level HRA (Transport Scotland, 2015), including maximising distance between any dualling works and the SAC boundary, minimising additional crossings of the River Tay SAC and minimising permanent new structures in watercourses.

11.5.19 Habitat loss would be mitigated through the provision of new habitat in landscape design which would aim to reduce fragmentation (of habitats and their supporting species) and create new linkages or more ecologically resilient functional units. Replacement habitat would be identified for the Preferred Route Option at DMRB Stage 3 but would require careful planning to avoid creating habitats for invasive species such as grey squirrels (*Sciurus carolinensis*).

11.5.20 Aquatic habitat loss would be reduced through the implementation of an appropriate channel design for the realigned sections of Inchewan Burn for Options ST2A and ST2B to ensure that suitable flows are present in the channel. Sediment supply to the downstream reach can be artificially maintained by re-distributing accumulated material from the upstream sediment basin. This would prevent some of the degradation of the habitat in the lower reach of the watercourse and allow re-establishment of fish habitat downstream of the culvert. Additionally, strategic placement of boulders within the channel downstream of the culvert could be used to create optimal flows and step pool sequences.

11.5.21 In relation to the conceptual landscape mitigation in Volume 1, Part 3 – Environmental Assessment (Chapter 12: Landscape), it is recognised that there is potential for Option ST2A to lead to increased habitat connectivity compared to the other three proposed route options. This is due to up to 4ha (depending on service infrastructure and recreational paths) of new planting (primarily scrub and ground flora species) on top of the cut and cover tunnel, which would provide a corridor for animal movement including reptiles and bats, and additional breeding bird habitat

11.5.22 Areas of high-quality woodland listed on the AWI sites lost due to the proposed route options cannot be mitigated for due to the permanent loss of the biodiversity and intrinsic importance of this habitat. Therefore, compensation planting or off-setting would be required for each proposed route option. As this habitat matures, woodland corridors could potentially connect currently fragmented areas and the planting would therefore mitigate for the functions and importance of the woodland in respect to habitat connectivity and carrying capacity for other species. In the long-term, significant residual effects are therefore predicted to reduce. A high-level assessment of potential locations for compensatory planting for lost AWI sites was undertaken and that identified sufficient suitable areas to fully compensate losses for all proposed route options, in cognisance of the current Climate Emergency, as declared by the Scottish Government (2019). Further compensation could include translocation of soils and/or other features associated with woodland habitat listed on the AWI. All areas of woodland habitat listed on the AWI within the Land Made Available (LMA) of the Preferred Route Option at DMRB Stage 3 would be assessed and mitigation considered in accordance with the mitigation hierarchy. Where loss is unavoidable, short- and medium-term losses of biodiversity would also be considered during the mitigation and any required compensation design.

11.5.23 Road run-off and its potential effects on the water quality of the River Tay SAC, and consequent effects on the population of qualifying species, undesignated wetland, watercourse and other aquatic habitats, would be mitigated by appropriate drainage design to minimise run-off of sediments directly into the watercourse. It should be noted that SuDS would be further developed as part of the DMRB Stage 3 design.

11.5.24 Potential for loss and/or fragmentation of protected species lying-up/resting/roosting sites for all options could be compensated for through:

- the provision of alternative sites;
- new planting to create linkages between existing habitats for species including red squirrel and pine marten (this would require careful planning to avoid creating habitat for invasive grey squirrels), particularly for Option ST2A where habitat could be established on top of the cut and cover tunnel; and
- planting to provide opportunities for above ground lying-up sites and foraging habitat for other species.

11.5.25 Potential fragmentation of otter and beaver habitats and associated barriers to access foraging areas could be mitigated through:

- the provision of mammal ledges in culverts and under bridges. Where this is not possible, dry mammal underpasses could be provided. Mammal- resistant fencing could be used in conjunction with crossing structures to increase effectiveness; and
- where appropriate, dedicated wildlife bridges or accommodation bridges with an enhanced design could be provided to increase the permeability of the proposed route options to wildlife movement.

11.5.26 Culvert design should aim to reduce the potential for damming by beaver, including in-stream fencing or grilles (Campbell-Palmer et al., 2016). The requirement for beaver mitigation on culverts would be further assessed at DMRB Stage 3.

11.5.27 The impassable Inchewan Burn culvert drop structures for Options ST2A and ST2B would cause fragmentation of otter habitats and associated barriers to access foraging areas. For Option ST2A, connectivity along Inchewan Burn could be maintained through replacement planting, habitat creation and mammal-resistant fencing to divert otters over the cut and cover tunnel. For Option ST2B it is not possible to provide a dry mammal underpass or mammal ledges in the culvert and there is no means for otter to cross over the dualled A9 at this location. However, no potential significant effect is associated with this habitat fragmentation as the upper reaches of Inchewan Burn are considered to be accessible from the River Braan through Ladywell Plantation. Additional mitigation could be considered at DMRB Stage 3 to provide alternative connectivity.

11.5.28 Loss of migratory fish passage due to the presence of additional culverts and watercourse modifications as part of the project footprint could be reduced through the design of crossings in accordance with SEPA's Engineering in the Water Environment: Good Practice Guide - River Crossings (2010) and the River Crossings and Migratory Fish Design Guide (Scottish Executive, 2000) . Although this mitigation is applicable to all proposed route options for culverts and water crossings, such as the River Tay crossing and River Braan crossing, it is of particular importance for the design of the culvert at Inchewan Burn for Options ST2A and ST2B.

11.5.29 Disturbance to qualifying species of the River Tay SAC could be reduced for all proposed route options by appropriate lighting design to reduce spillage of light from operational road areas (roundabouts) into adjacent SAC habitats.

11.5.30 Operational disturbance to bats and migratory fish species could be reduced through:

- design of road lighting using current best practice, including directional lighting or other measures to reduce peripheral light spillage;
- avoidance of lighting in areas of migratory fish habitat at watercourse crossings; and
- use of noise barriers in areas of ecological interest deemed to be sensitive to noise (for example near buildings with bat roosts).

11.5.31 Increased direct mortality of otters and badgers as a consequence of the widened carriageway could be mitigated by appropriate design of crossings and the provision of mammal-proof fencing directing animals to crossing structures.

11.5.32 Potential for mortality of reptiles from accessing the dualled A9 and falling into drainage systems could be reduced through:

- provision of escape routes from roadside guttering and drainage;
- the avoidance of gully pots; and
- provision of dropped kerbs to facilitate exit from the carriageway.

Securing Positive Effects for Biodiversity

11.5.33 Under the Roads (Scotland) Act 1984 (as amended), opportunities for essential mitigation or compensation for biodiversity loss are not restricted to within the footprints of the proposed route options. It is, therefore, assumed for the purposes of this DMRB Stage 2 assessment that sufficient land for habitat creation would be able to be compulsorily purchased to mitigate or compensate for biodiversity losses for all proposed route options.

11.5.34 Enhancement for biodiversity gains is not limited to habitat creation and opportunities for habitat management can also be used to secure positive effects for biodiversity. Detailed mitigation would be designed at DMRB Stage 3 and it is assumed at DMRB Stage 2 that options for enhancement through management would be available to all proposed route options. Therefore, only additional land available

for planting within the footprints of the proposed route options is considered to undertake a high-level comparison of the opportunities for biodiversity gains for each proposed route option.

11.5.35 For all proposed route options, the majority of land available for habitat creation within the footprints is along embankments and cuttings. These areas are often small and fragmented and offer limited opportunities for functional habitat units to provide biodiversity gains. Only Option ST2A has additional land available for habitat creation, a site of approximately 4ha on top of the cut and cover tunnel. However, it is recognised that planting compositions on top of the cut and cover tunnel would likely be restricted to only grassland and shrubs and, therefore, would not be available to mitigate or compensate for the loss of woodland habitat.

11.5.36 This assessment has identified Option ST2A as the only proposed route option that would potentially provide an additional opportunity for biodiversity gains through habitat creation.

11.6 Summary of Route Options Assessment

11.6.1 This section provides a summary of the DMRB Stage 2 assessment of potential impacts and associated effects for the proposed options, taking into account the anticipated potential mitigation as described in Section 11.5 (Potential Mitigation).

11.6.2 For the comparison of proposed route options, two aspects are considered: whether the potential for residual effects would be considered significant in the context of the EIA Regulations; and whether any of the potential impacts and effects identified differ sufficiently between proposed route options such that they can be considered a differentiator and need to be considered as part of the overall identification of the Preferred Route Option which, as explained in Volume 1, Part 3 – Environmental Assessment (Chapter 7: Overview of Environmental Assessment), takes into account environmental, engineering, economic and traffic considerations.

11.6.3 The DMRB Stage 2 assessment of biodiversity has identified potential significant effects associated with the proposed route options as shown in Table 11.6. Potential residual significant effects (after mitigation), have also been identified as summarised in Table 11.7.

Securing Positive Effects for Biodiversity

11.6.4 Specific mitigation is not developed until DMRB Stage 3; therefore, it is not possible to calculate in this DMRB Stage 2 assessment whether one proposed route option would lead to a greater biodiversity gains compared to another. However, proxies for biodiversity loss and potential areas of biodiversity gain have been considered.

11.6.5 The horizontal route alignments for the proposed route options are roughly equal; therefore, the majority of the biodiversity losses would be approximately the same. To account for difference between the proposed route options, loss of AWI sites has been used as a proxy for loss of biodiversity. Option ST2A is determined to potentially lose the largest amount of habitat listed on AWI sites, and Option ST2D potentially the least.

11.6.6 Despite Option ST2A providing an additional opportunity for additional habitat creation, this would not be suitable as a site for compensatory woodland planting and Option ST2A is losing the largest amount of habitat listed on AWI sites, which is potentially irreplaceable. As Option ST2D would result in the loss of the least amount of habitat listed on AWI sites, Option ST2D would have the least requirements for compensatory woodland planting and therefore be potentially the easiest of the proposed route options to secure positive effects for biodiversity at DMRB Stage 3.

Construction

11.6.7 A potentially greater risk of general construction related impacts and associated effects, such as habitat degradation from dust and run-off, and disturbance from noise and vibration, has been identified for Option ST2A due to the requirement for more extensive construction related activities to construct the cut and cover tunnel. However, it is anticipated that these potential impacts and associated effects would generally be mitigated through construction best practice and the implementation of measures that would be detailed in the CEMP as well as noise and vibration management plans (see 11.5 for proposed construction mitigation). With the incorporation of mitigation measures, general construction related potential impacts and effects, as listed above, for Option ST2A, would not be considered significant under the terms of the EIA Regulations.

11.6.8 Options ST2A and ST2B have potential construction related residual significant effects on fish species of conservation interest due to fragmentation of habitat from the lowering of Inchewan Burn. Options ST2C and ST2D do not involve the lowering of Inchewan Burn and therefore do not have the associated potential significant effect.

11.6.9 It is anticipated that there would be no construction related residual significant effects for Options ST2C and ST2D following the mitigation in Section 11.5. This is due to either avoidance of impacts and associated effects (including noise or vibration at sensitive times, dust deposition, run-off and sediment release) or due to measures to avoid mortality and injury to protected fauna.

11.6.10 Options ST2A and ST2B involve the realignment and lowering of the Inchewan Burn into a culverted drop structure which would be impassable to otter, leading to habitat fragmentation along the burn. However, otter field signs recorded within Ladywell Plantation indicates that the upper reaches of Inchewan Burn are likely accessible from the River Braan and therefore fragmentation of Inchewan Burn would not inhibit otters from accessing the upper reaches. As such, no additional construction related effects are predicted for otter with regards to Options ST2A and ST2B.

11.6.11 The potential for residual significant effects during construction are considered to be a differentiator between proposed route options and a comparative assessment is reported in Table 11.7.

Operation

11.6.12 Permanent loss of AWI sites remains a potential operation related residual significant effect for all proposed route options. The area of AWI sites lost does not differ significantly between proposed route options and is therefore not considered a differentiator between proposed route options. A high-level assessment of potential locations for compensatory planting for lost AWI sites was undertaken and identified suitable areas to fully compensate losses for all proposed route options. This would be considered in more detail as part of the DMRB Stage 3 assessment.

11.6.13 Options ST2A and ST2B have potential operation related residual effects on fish species of conservation interest due to permanent geomorphological changes to Inchewan Burn, which is not the case with Options ST2C and ST2D. This is due to the realignment and lowering of the Inchewan Burn into a culvert with associated sediment trap, trash screen and impassable drop structure. This would cause habitat fragmentation, preventing access to upstream suitable fish habitat, and permanently affect the bed downstream of the culvert.

11.6.14 The culvert for the realigned Inchewan Burn for Options ST2A and ST2B requires a drop structure impassable to otter. For Option ST2A, during operation, connectivity along Inchewan Burn would be restored as otter would be able to cross over the cut and cover tunnel. This is not possible for Option ST2B. However, the upper reaches of Inchewan Burn would be accessible from the River Braan through Ladywell Plantation and therefore otter would not be inhibited from accessing upstream of the culvert

drop structure. As such, no additional operational related effects are predicted for otter with regards to Options ST2A and ST2B.

11.6.15 The potential for residual significant effects during operation are considered to be a differentiator between proposed route options and a comparative assessment is reported in Table 11.7.

Table 11.7 Summary of Assessment of All Route Options – Biodiversity

Chapter/ Subcategory		Potential Residual Effects				Comments
		Option ST2A	Option ST2B	Option ST2C	Option ST2D	
Biodiversity	Construction	Residual significant effect on fish species of conservation interest as a result of habitat fragmentation at Inchewan Burn.	Residual significant effect on fish species of conservation interest as a result of habitat fragmentation at Inchewan Burn.	No significant residual effects	No significant residual effects	The differences in effects on fish species of conservation interest as a result of habitat fragmentation at Inchewan Burn are considered sufficient to differentiate between proposed route options.
	Operation	Residual significant effect on fish species of conservation interest as a result of habitat fragmentation at Inchewan Burn. Residual significant effect as a result of losing 20.58ha of AWI sites.	Residual significant effect on fish species of conservation interest as a result of habitat fragmentation at Inchewan Burn. Residual significant effect as a result of losing 17.08ha of AWI sites.	Residual significant effect as a result of losing 18.12ha of AWI sites.	Residual significant effect as a result of losing 16.56ha of AWI sites.	The differences in effects on fish species of conservation interest as a result of habitat fragmentation at Inchewan Burn and the loss of AWI sites are considered sufficient to differentiate between proposed route options.

Compliance Against Plans and Policies

11.6.16 DMRB LA 104 states that environmental assessment, reporting and monitoring shall meet the requirements of the national planning policy for each relevant Overseeing Organisation.

11.6.17 *Appendix A21.1 (Assessment of Policy Compliance)* provides a review of national, regional and local policy documents which are of relevance to this assessment undertaken and reported in this chapter in accordance with DMRB guidance.

11.6.18 National Planning Policy objectives (and accompanying best practice guidance) of relevance to this assessment are provided in National Planning Framework 3 (Scottish Government, 2014a), Scottish Planning Policy (SPP) (Scottish Government, 2014b) theme 'Valuing the Natural Environment', as well as the 2020 Challenge for Scotland's Biodiversity (Scottish Government, 2013), the Environment Strategy for Scotland: Vision and Outcomes (Scottish Government, 2020) and The Scottish Government's Policy on Control of Woodland Removal (Forestry Commission Scotland, 2009). In addition, local policies of relevance include Perth and Kinross Local Development Plan 2 (PKC LDP2) Policies 38 (Environment and Conservation), 40 (Forestry, Woodland and Trees), 41 (Biodiversity) and 42 (Green Infrastructure). TAYplan Policies 2 (Shaping Better Quality Places) and 9 (Managing TAYplan's Assets) are also of relevance.

11.6.19 A full policy compliance assessment can be found in Table 4 of *Appendix A21.1 (Assessment of Policy Compliance)*. Further assessment is required at DMRB Stage 3 in order to assess compliance in relation to impacts upon designated sites and trees and woodland. However, at this stage non-compliance with national, regional and local policy is assessed in relation to significant effects upon fish species of conservation interest for proposed route options ST2A and ST2B.

Community Objectives

11.6.20 The Community Objectives (refer to Volume 1, Part 3 – Environmental Assessment (Chapter 7: Overview of Environmental Assessment, Table 7.2)) have been considered throughout DMRB Stage 2. *Appendix A7.1: Mapping of Community Objectives Against DMRB Stage 2 Route Options* sets out which DMRB Stage 2 environmental topics are relevant to each of the objectives.

11.6.21 *Appendix A7.1: Mapping of Community Objectives Against DMRB Stage 2 Route Options* confirms that community objective 2 is relevant to the assessment of Biodiversity. Professional judgement has been used to consider how the proposed route options contribute to this objective for the operation phase, as summarised in Table 11.6.

11.6.22 The contribution of the operation phase of each of the proposed route options to the relevant community objectives was categorised according to the following key.

Contributes to all/most of the community objective

Contributes to part of the community objective

Contributes to little/none of the community objective

Table 11.8: Contribution to Community Objectives During Operation for this Environmental Topic

Relevant Community Objective		Option ST2A	Option ST2B	Option ST2C	Option ST2D
2	Protect and enhance the scenic beauty and natural heritage of the area and its distinctive character and quality.				

11.6.23 The scenic beauty and natural heritage of the Birnam to Tay Crossing section of the A9 Dualling, includes ancient woodland habitat and watercourses crossed by the proposed route options. All proposed route options result in the removal of ancient woodland habitat, which may affect the scenic beauty and natural heritage of the area, in addition to its distinctive character and quality. Therefore, at this stage in the assessment, the proposed route options are considered to contribute little/none to community objective 2, although mitigation would be developed at DMRB Stage 3 with the aim to reduce the significant effects of the Preferred Route Option.

Comparative Assessment

11.6.24 As shown in Table 11.7, there is a differentiator between potential effects for the proposed route options (Options ST2A/ST2B and Options ST2C/ST2D) in relation to both construction and operation. Option ST2A and Option ST2B both give rise to the highest potential significant effects to biodiversity resources due to the potential for effects on fish species of conservation interest as shown in Table 11.9.

Table 11.9 Comparative Assessment – Biodiversity

Route Option	Lowest Overall Effect	Intermediate Overall Effect	Highest Overall Effect
Option ST2A			✓
Option ST2B			✓
Option ST2C	✓		
Option ST2D	✓		

11.7 Scope of Stage 3 Assessment

11.7.1 It is proposed that the Stage 3 assessment for Biodiversity would be undertaken in accordance with the DMRB, in particular with DMRB LA 108. The scope of the assessment of the Preferred Route Option would be similar to that undertaken at DMRB Stage 2, with a number of additional steps and comparisons made.

11.7.2 Further site surveys for the DMRB Stage 3 assessment would include:

- bat Preliminary Roost Assessments (PRA) and Winter Hibernation Inspections (WHI) surveys, emergence and re-entry surveys of buildings and structures with moderate and high bat roost potential;
- walkover surveys for field signs off badger, beaver, otter, red squirrel and pine marten;
- transect surveys for breeding birds;
- reptile refuge searches using artificial cover objects;
- fish habitat assessments and migratory fish surveys;
- further site surveys to determine the presence of FWPM populations in relation to proposed outfall and scheme crossing points locations;
- invertebrate surveys in consultation with statutory consultees;
- targeted site visits to update baseline habitat survey data in areas of notable habitat change (e.g. felled woodland); and
- surveys to determine ancient woodland characteristics and woodland condition.

11.7.3 It is anticipated that the DMRB Stage 3 assessment would include the following:

- assessment of the Preferred Route Option's nature conservation impacts and their significance, particularly on the River Tay SAC, ancient woodland and other terrestrial habitats, and protected species;
- consideration of design changes or works to avoid or reduce potential impacts;
- consideration of detailed design for currently undefined elements of the project, such as footpath access to accommodate relocation of the Dunkeld & Birnam Station if that were to be taken forward;
- confirmation of the views of relevant statutory bodies on the nature conservation impacts of the Preferred Route Option;
- consideration of ancient woodland strategy;
- consideration of approach to securing positive effects for biodiversity in consultation with statutory consultees;

- identification of required mitigation, including provision for species to pass across the A9 route (including making use of existing baseline information on the characteristics of existing culverts, through which some species may cross), and replacement and compensatory habitat planting; and
- identification of monitoring methods of mitigation notably for ancient woodland compensation.

11.7.4 The scope identified above aligns with the recommendations made in the SEA (Transport Scotland, 2013, 2014d, 2014e) for the DMRB Stage 3 assessment.

11.7.5 In addition to input at DMRB Stage 3, an HRA report would be prepared to consider the implications from the project on the European sites, in particular the River Tay SAC, under the requirements of the Habitats Regulations 1994 (as amended).

11.8 References

National Legislation and EU Directives

Council Directive 2009/147/EC on the conservation of wild birds

Conservation (Natural Habitats, &c.) Regulations 1994 (as amended)

Conservation (Natural Habitats, &c.) (EU Exit) (Scotland) (Amendment) Regulations 2019

Convention on Biological Diversity (CBD)

Convention on the Conservation of European Wildlife and Natural Habitats (the Bern Convention)

Convention on Wetlands of International Importance especially as Waterfowl Habitat (the Ramsar Convention)

Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora

Council Regulations (EC) No 1100/2007 Establishing Measures for the Recovery of the Stock of European Eel

European Union (Withdrawal Agreement) Act 2020

Freshwater Fish Conservation (Prohibition on Fishing for Eels) (Scotland) Regulations 2008

Nature Conservation (Scotland) Act 2004

Salmon and Freshwater Fisheries (Consolidation) (Scotland) Act 2003

The Roads (Scotland) Act 1984 (as amended)

Wildlife and Countryside Act 1981 (as amended)

Wildlife and Natural Environment (Scotland) Act 2011

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12. Landscape

12.1 Introduction

12.1.1 This chapter presents the Design Manual for Roads and Bridges (DMRB) Stage 2 assessment of the proposed route options in relation to the potential effects on the landscape resource, including the constituent elements of the landscape, its specific aesthetic and perceptual qualities, landscape and other landscape-related designations, and its character.

12.1.2 The chapter identifies and describes: the baseline situation within the adopted study area; the potential impacts and effects likely to result from each of the proposed route options (during construction and operation); the potential mitigation measures which could be implemented in order to reduce the effects of each proposed route option on the landscape resource; and the predicted residual effects on the landscape resource likely to result from each of the proposed route options. This includes identification of the predicted effects on the landscape resource which would be common to two or more of the proposed route options and the predicted effects that would be unique to each proposed route option.

12.1.3 The chapter also provides a comparative assessment of the proposed route options and identification of which of the proposed route options is (or are) likely to have the least effect on the landscape, and which of the proposed route options is (or are) likely to have the highest overall effect. This comparative assessment is provided at the end of the chapter.

12.1.4 A separate but inter-related visual assessment, which considers the effects of the proposed route options on specific views and the general visual amenity experienced by people, is reported in Volume 1, Part 3 – Environmental Assessment (Chapter 13: Visual). An assessment of the effects of the proposed route options upon the views experienced by travellers is included in Volume 1, Part 3 – Environmental Assessment (Chapter 13: Visual and *Appendix A13.2: View from the Road*). These chapters should therefore also be referred to with regard to effects on the landscape resource.

12.1.5 A description of each of the proposed route options assessed is provided in Volume 1, Part 3 – Environmental Assessment (Chapter 7: Overview of Environmental Assessment). The proposed route options comprise:

- Option ST2A (Community's Preferred Route Option);
- Option ST2B;
- Option ST2C: and
- Option ST2D.

Legislative and Policy Background

National Policy

National Planning Framework 3 (NPF3) (Scottish Government, 2014a)

12.1.6 National Planning Framework 3 (NPF3) 2014, was produced by the Scottish Government as a guide to Scotland's spatial development priorities for the next 20 to 30 years. The vision set in this document is divided into four outcomes, of which one, 'a natural, resilient place', is key to landscape and visual considerations. NPF3 highlights the importance of not only designated landscapes, including National Scenic Area and National Parks, but that all landscapes support place-making and contribute to sustaining local distinctiveness, people's quality of life, health and wellbeing, national identity and the visitor economy (Paragraphs 4.4, 4.12 and 4.13). NPF3 also mentions the need to improve the '*quality*

of the landscape setting' of Scotland's towns and cities and manage change on the urban edge (Paragraph 4.18).

Scottish Planning Policy (SPP) (Scottish Government, 2014b; Revised 2020)

12.1.7 Scottish Planning Policy (SPP) is focused on increasing the country's sustainable economic growth through plan making, development design and planning decisions. SPP also mentions the importance of enabling development and use of land while also protecting and enhancing Scotland's cultural and natural resources (Paragraph 2).

12.1.8 Like NPF3, promoting *'a natural, resilient place'* is a key part of creating quality places and Paragraphs 194 to 233 of SPP focuses on landscape and the natural environment, including designations and Green Infrastructure. Paragraph 202 highlights that the local landscape character should be considered in the siting and design of development and that planning decisions should consider the potential effects on the environment, landscapes and cumulative impacts.

Regional Policy

TAYplan: Strategic Development Plan (2016 – 2036) (TAYplan, 2017)

12.1.9 The following sets out the main policies relevant to landscape considerations of the proposed route options.

12.1.10 Policy 2 (Shaping Better Quality Places) recognises that development proposals should be: '*Place-led to deliver distinctive places…incorporating and enhancing natural and historic assets, natural processes, the multiple roles of infrastructure and networks, and local design context*.' This policy also explains that development proposals should be: '*Resilient and future-ready by ensuring that adaptability and resilience to a changing climate are built into the natural and built environments through… identifying, retaining and enhancing existing green networks and providing additional networks of green infrastructure (including planting in advance of development) …*' (p.12).

12.1.11 Policy 8 (Green Networks) states: *'Strategies, Policies, Plans and Programmes shall protect and enhance green and blue networks by ensuring that: i. development does not lead to the fragmentation of existing green networks… and iii. the provision of networks of green infrastructure is a core component of any relevant design framework, development brief or masterplan.'* This policy also states: *'Local Development Plans should identify existing key networks of green infrastructure and opportunities to enhance them to maximise the benefits they provide. Improvements should include: i. better recreational access opportunities and active travel routes; ii. improvements to habitat networks and green spaces; iii. more widespread use of green infrastructure for water management; and, iv. an overall enhancement to quality of the place.'* (p.46).

12.1.12 Policy 9 (Managing Tayplan's Assets) states: '*Land should be identified through Local Development Plans to ensure responsible management of TAYplan's assets by…. Safeguarding the integrity of natural and historic assets.* The Plan sets out that this would be achieved by: *… 'understanding and respecting the regional distinctiveness and scenic value of the TAYplan area through safeguarding the integrity of natural and historic assets; including habitats, wild land, sensitive green spaces, forestry, water environment, wetlands, floodplains (in-line with the Water Framework Directive), carbon sinks, species and wildlife corridors, and also geo-diversity, landscapes, parks, townscapes, archaeology, historic battlefields, historic buildings and monuments; and by allowing development where it does not adversely impact upon or preferably enhances these assets.'* (p.50).

Local Policy and Guidance

Perth and Kinross Local Development Plan 2 (PKC, 2019)

12.1.13 Perth & Kinross Council's (PKC's) Local Development Plan 2 (LDP) (Adopted 29 November 2019) includes a number of policies which seek to protect important landscapes and landscape features from inappropriate development, and also to shape the design of development to conserve and enhance the landscape quality. The following sets out the main policies relevant to landscape and visual considerations of the proposed route options.

12.1.14 Policy 1 (Placemaking) states: *'Development must contribute positively to the quality of the surrounding built and natural environment. All development should be planned and designed with reference to climate change, mitigation and adaptation. The design, density and siting of development should respect the character and amenity of the place, and should create and improve links within and, where practical, beyond the site. Proposals should also incorporate new landscape and planting works appropriate to the local context and the scale and nature of the development. All proposals should… Consider and respect site topography and any surrounding important landmarks, views or skylines, as well as the wider landscape character of the area…Incorporate green infrastructure into new developments to promote active travel and make connections where possible to blue and green networks'* (p.20).

12.1.15 Section 3.3 (A Natural, Resilient Place) features Key Objectives including: '*Protect and enhance the character, diversity, and special qualities of the area's landscapes to ensure that new development does not exceed the capacity of the landscape in which it lies*' (p.66).

12.1.16 Policy 39 (Landscape) states: *'Development and land use change, including the creation of new hill tracks, should be compatible with the distinctive characteristics and features of Perth and Kinross's landscapes; which requires reference to the Tayside Landscape Character Assessment. Accordingly, development proposals will be supported where they do not conflict with the aim of maintaining and enhancing the landscape qualities of Perth and Kinross'* (p.70).

12.1.17 Policy 40 (Forestry, Woodland and Trees) describes how *'The Council will support proposals which… protect existing trees/woodland including orchards, especially those with high natural, historic and cultural heritage value…seek to secure establishment of new woodland in advance of major developments where practicable and secure new tree planting in line with the guidance contained in the Perth and Kinross Forest and Woodland Strategy. The planting of native trees and woodland will be sought where it is appropriate'* (p.71).

12.1.18 Policy 42 (Green Infrastructure) explains *'The Council will require all new development to contribute to green infrastructure by…creating new multifunctional green infrastructure, particularly where it can be used to mitigate any negative environmental impacts of the development, and/or create linkages to wider green and blue networks… incorporating high standards of environmental design…ensuring that development does not lead to the fragmentation of existing green and blue networks…'* (p.75).

Forest and Woodland Strategy, 2014- 2024 Supplementary Guidance (PKC, 2019)

12.1.19 The Forest and Woodland Strategy Supplementary Guidance is relevant to landscape considerations of the proposed route options.

12.1.20 There are seven themes that contribute to the delivery of the guidance, including *'Environmental Quality'*, which takes into account the protection and enhancement of the quality of natural resources, improving scenery and use of the area's unique historic environment.

12.2 Approach and Methods

Scope and Guidance

12.2.1 This DMRB Stage 2 landscape assessment was undertaken in accordance with DMRB LA 107 'Landscape and visual effects' Revision 1 (Highways England et al., 2020b), and with reference to Guidelines for Landscape and Visual Impact Assessment 3rd Edition (GLVIA3) (Landscape Institute and IEMA, 2013).

12.2.1 In addition, the approach to the assessment has been informed by Fitting Landscapes: Securing more Sustainable Landscapes (Transport Scotland, 2014a) and Planning Advice Note (PAN) 1/2013: Environmental Impact Assessment Revision 1 (Scottish Government, 2017). Agreed collective assessment methodology has been developed for the A9 Dualling Programme through consultation with key environmental stakeholders (including NatureScot and PKC).

Approach and Methodology

12.2.2 The approach and methods have been informed by the recommendations made in the A9 Dualling Programme Strategic Environmental Assessment (SEA) Report (Transport Scotland, 2013). For Landscape, recommendations included that early consultation with NatureScot, and Historic Environment Scotland (HES) be undertaken regarding potential effects on receptors including the River Tay (Dunkeld) National Scenic Area (NSA) and that the results of this consultation are taken account of in this assessment.

Study Area

12.2.3 The study area for the landscape assessment is shown on Figure 12.1. It comprises an area extending up to 5km in distance to either side of the road corridor and 5km to the north and south of the extents of the proposed route options.

12.2.4 Within this study area, Zone of Theoretical Visibility (ZTV) mapping has been prepared for the existing A9 and for each of the proposed route options, as shown on Figures 13.2 to 13.3 which accompany Volume 1, Part 3 – Environmental Assessment (Chapter 13: Visual). These ZTVs have been produced using a bare-earth Digital Terrain Model (DTM) and show the maximum extent of the area from which the existing A9 and each proposed route option (including vehicles) may be visible for a view height of 1.5m. For the 'target' height, the ZTVs add 4.5m to the existing A9 and proposed route options. This is in order to take into account the movement of traffic, including Heavy Goods Vehicles (HGVs), and potential effects arising from this. However, the ZTVs do not take into account screening or filtering of visibility by local landform features not captured by the DTM, built features or vegetation, which were established and considered during subsequent site survey work which was then taken account of in this assessment.

12.2.5 The landscape assessment has focused mainly on potential landscape effects along the route of the road and up to 5km from it, as based on professional experience and judgement; this is where significant effects are most likely to result from physical changes made by the proposed route options or changes to the setting of key features. Although it is possible that there may be some effects on the perception of the landscape at greater distances, these are not likely to be significant and would be unlikely to assist in differentiation between the proposed route options, given the relatively narrow corridor within which these are located.

Baseline Conditions

12.2.6 The first stage of the assessment was to establish the baseline landscape resource against which subsequent change resulting from the proposed route options could be identified.

12.2.7 Baseline landscape conditions are those that exist at the time of desk and site survey, but also take into account both future changes that are assumed certain (e.g. an approved housing development where construction is yet to commence but would result in change to local landscape character and elements), as well as considering likely future changes to the landscape (e.g. harvesting and re-stocking of commercial forestry plantations).

Desk-based Assessment

12.2.8 Baseline information was collected through a desk study including review of the following information sources:

- 1:5,000, 1:10,000, 1:25,000 and 1:50,000 Ordnance Survey (OS) mapping;
- Google Earth web-based photography;
- Historic Environment Scotland: Inventory of Gardens & Designed Landscapes;
- aerial photography provided by Transport Scotland (including BLOM Survey, 2014);
- Jacobs Geographic Information System (GIS) environmental constraints datasets (obtained through consultation with relevant stakeholders);
- A9 Dualling Programme. Strategic Environmental Assessment (SEA) Report. (Transport Scotland, 2013);
- A9 Dualling Programme. Strategic Environmental Assessment (SEA). Environmental Report Addendum. Appendix F – Strategic Landscape Review Report (Transport Scotland, 2014b);
- Landscape Study to Inform Planning for Wind Energy Final Report (David Tyldesley and Associates/PKC, 2010);
- Landscape Supplementary Guidance (PKC, 2020);
- Forest & Woodland Strategy 2014 - 2024 Supplementary Guidance (PKC, 2020);
- PKC Local Development Plan 2 (PKC, 2019);
- TAYplan: Strategic Development Plan (2016 – 2036) (TAYplan, 2017);
- The Special Qualities of the National Scenic Areas, NatureScot Commissioned Report No.374 (NatureScot, 2010); and
- NatureScot, Landscape Character Assessment in Scotland web page and Landscape Character Types Map and Descriptions, 2019.

Site Surveys

12.2.9 Site surveys were carried out by a team of landscape architects on foot and by car during both summer and winter conditions. During the site surveys, information on landscape features and characteristics was collected, as well as photographs of landscape features that may be physically affected and photographs to/from locations within the landscape that may have potential visibility of the proposed route options.

Consultation

12.2.10 A summary of the consultation is reported in Volume 1, Part 3 – Environmental Assessment (Chapter 7: Overview of Environmental Assessment, Section 7.6 (Consultation)). Key consultations that have informed this assessment are summarised in the following paragraph.

12.2.11 Consultation has been undertaken throughout the DMRB Stage 2 assessment process, including with NatureScot[1] and PKC. This has included agreement of approach to assessment on this project and on other A9 dualling projects, identification of viewpoint locations, and review of design and landscape options (such as slope gradients and replacement woodland opportunities).

Assessment of Potential Impacts and Effects

12.2.12 The assessment of impacts and effects resulting from the proposed route options has been undertaken in accordance with the guidance provided in DMRB LA 107. As such, the assessment identifies and assesses the significance of effects on the landscape as a resource. As discussed below, the significance of effects on the landscape has been assessed based on identification of the sensitivity to change of the landscape and the magnitude of impacts that would result from the construction and operation of each of the proposed route options.

Sensitivity to Change

12.2.13 The assessment of sensitivity combines judgements on the susceptibility of the landscape receptor to the specific type of development proposed, and the value attributed to that receptor. These aspects of the assessment are described below.

Landscape Susceptibility

12.2.14 Susceptibility is defined in GLVIA3 as *'the ability of the landscape receptor… to accommodate the proposed development without undue consequences for the maintenance of the baseline situation …'*. The susceptibility of landscape receptors to change is assessed using the criteria detailed in Table 12.1, along with professional judgement (where applicable, interims of medium/high or low/medium may be used where considered appropriate).

Table 12.1: Landscape Susceptibility Criteria

Susceptibility	Criteria
High	Little ability to accommodate the proposed route option without undue consequences.
Medium	Some ability to accommodate the proposed route option without undue consequences.
Low	Substantial ability to accommodate the proposed route option without undue consequences.

Landscape Value

12.2.15 GLVIA3 defines landscape value as *'the relative value that is attached to different landscapes by society… Value can apply to areas of landscape as a whole, or to the individual elements, features and aesthetic or perceptual dimensions which contribute to the character of the landscape'*. A review of existing designations (e.g. NSA, Special Landscape Area (SLA) etc.) is usually the starting point in understanding value, although it should be noted that value and/or associated susceptibility may not necessarily be uniform across a designated area. There may also be situations where an undesignated landscape is of value and/or has susceptibility in local terms. Table 12.2 sets out the relative importance of generic landscape designations and descriptions.

[1] In August 2020, Scottish Natural Heritage (SNH) was rebranded to NatureScot.

Table 12.2: Criteria for Assessing Value of Designated Landscapes

Designation	Description	Value
World Heritage Sites	Unique sites, features or areas identified as being of international importance according to UNESCO criteria. Consideration should be given to their settings, especially where these contribute to the special qualities for which the landscape is valued.	International /national
National Parks, National Scenic Areas	Areas of landscape identified as being of national importance for their Natural Beauty (and in the case of National Parks the opportunities they offer for outdoor recreation).	
Historic Environment Scotland Inventory of Gardens and Designed Landscapes	Gardens and designed landscapes included on the inventory.	
Local Landscape Designations included in local planning documents (such as Special or Local Landscape Areas, Areas of Great Landscape Value and similar), Conservation Areas	Areas of landscape identified as having importance at the local authority level.	Regional/ local

12.2.16 Establishing the value of undesignated areas requires examination of individual elements of the landscape. A number of criteria were considered to help determine value as detailed in Table 12.3 and an overall assessment was made for each receptor in terms of high, medium and low value.

Table 12.3: Criteria for Assessing Value of Non-Designated Landscapes

Attribute	Description
Landscape Quality (Condition)	A measure of the physical state of the landscape; its intactness and the condition of individual elements.
Scenic Quality	General appeal of the landscape to the senses.
Rarity	The presence of rare elements, features or landscape types.
Representativeness	Characteristic/feature/element considered a particularly important example.
Conservation/Cultural Interest	The presence of wildlife, earth science or cultural heritage interest which contributes positively to the landscape.
Recreation Value	Evidence that the landscape is valued for recreational activities where experience of the landscape is important.
Perceptual Aspects	Evidence that a landscape is valued for its wildness/tranquillity.
Associations	Relevant associations with notable figures, such as writers or artists, or events in history that contribute to landscape value.

Evaluation of Landscape Sensitivity

12.2.17 The sensitivity to change of the landscape was assessed based on consideration of both susceptibility and value on a five-point scale. Table 12.4 presents the criteria used, along with professional judgement, to inform the evaluation of landscape sensitivity.

Table 12.4: Landscape Sensitivity Criteria

Sensitivity	Criteria
Very High	Landscape of international or high national importance or value with particularly distinctive character, which is considered highly susceptible to relatively small changes. Landscape which by nature of its character and value would have very limited capacity to accommodate change of the type proposed without substantial loss/gain.
High	Landscape of national or regional importance of distinctive character which is considered susceptible to relatively small changes. Landscape which by nature of its character and value would have limited capacity to accommodate change of the type proposed, areas of strong sense of place.
Medium	Landscape of local or community importance with moderately valued characteristics considered reasonably tolerant of change. Some ability to accommodate the proposed change without undue detriment. Landscape which by nature of its character and value would be able to partly accommodate change of the type proposed.
Low	Landscape of generally low-valued characteristics considered potentially tolerant of substantial change. Landscapes which by nature of their character and value would be able to accommodate change of the type proposed.
Negligible	Landscape of very low importance with a high capacity to accommodate change of the type proposed without detriment.

Magnitude

12.2.18 The magnitude of landscape effects was considered in terms of size or scale, the geographical extent of the area influenced, duration and reversibility.

Size or Scale

12.2.19 The size and/or scale of change in the landscape takes into consideration the following factors:

- the extent/proportion of landscape elements lost or added;
- the contribution of that element to landscape character and the degree to which aesthetic/perceptual aspects are altered; and
- whether the change is likely to alter the key characteristics of the landscape, which are critical to its distinctive character.

Geographical Extent

12.2.20 The geographical area that may experience landscape effects can generally be considered at the following scales:

- proposed scheme level;
- the immediate setting of the proposed scheme;
- the landscape character area that the proposed scheme would lie within; or
- across several landscape character areas where influences occur on a larger scale.

Duration and Reversibility

12.2.21 In accordance with DMRB LA 107 and GLVIA3, consideration is also given to the duration and reversibility of landscape effects in the evaluation of magnitude. The duration of effects is judged on the following scale:

- short-term: under 1 year;
- medium-term: 1-15 years; and
- long-term: over 15 years.

Evaluation of Magnitude

12.2.22 The magnitude of landscape impact was assessed on a five-point scale, taking account of the degree of landscape change that would occur as a result of the proposed scheme, as described in Table 12.5 and as set out in Table 3.4 of DMRB LA 104 'Environmental assessment and monitoring' (Highways England et al., 2020a). The permanent operation-phase effects of the proposed scheme are of long-term duration and largely irreversible so are considered of greater magnitude than temporary construction-phase effects such as those arising from haul roads, which are typically short-term and reversible.

Table 12.5: Magnitude of Landscape Impact

Magnitude	Criteria
Major	Notable change in landscape characteristics over an extensive area ranging to very intensive change over a more limited area.
Moderate	Slight changes in landscape characteristics over a wide area ranging to notable changes in a more limited area.
Minor	Localised slight change in landscape characteristics, or to any components of the landscape.
Negligible	Virtually imperceptible change in landscape characteristics over a small area, or to any components of the landscape.
No Change	No perceptible change to the landscape resource.

12.2.23 The operational impacts of the proposed route options are considered to be of long-term duration and largely irreversible, thus increasing magnitude. However, temporary construction phase impacts are often short-term and reversible and thus likely to have a lower magnitude.

Significance of Effects

12.2.24 The significance of landscape effects has been determined through professional judgement with reference to the significance matrix set provided below in Table 12.6 (and as set out in Table 3.8.1 of DMRB LA 104). The determination of the significance of effect has been based on consideration of both the sensitivity of the landscape receptors and the predicted magnitude of impacts as a result of the proposed scheme, and defined as being Neutral, Slight, Moderate, Large or Very Large as shown in Table 12.7.

Table 12.6: Significance Matrix

Magnitude / Sensitivity	No change	Negligible	Minor	Moderate	Major
Very High	Neutral	Slight	**Moderate** or **Large**	**Large** or **Very Large**	**Very Large**
High	Neutral	Slight	Slight or **Moderate**	**Moderate** or **Large**	**Large** or **Very Large**
Medium	Neutral	Neutral or Slight	Slight	**Moderate**	**Moderate** or **Large**
Low	Neutral	Neutral or Slight	Neutral or Slight	Slight	Slight or **Moderate**
Negligible	Neutral	Neutral	Neutral or Slight	Neutral or Slight	Slight

12.2.25 Effects assessed as being of Moderate significance or greater are considered to constitute significant changes to the fabric, character and/or quality of the landscape, and mitigation would generally be required to reduce these where practicable.

Table 12.7: Significance of Landscape Effects

Significance	Criteria
Very Large	Adverse: The proposed route option would be at very considerable variance with the character (including quality and value) and/or special qualities of the landscape receptor, degrade or diminish the integrity of a range of characteristic features or elements or damage a sense of place. Beneficial: The proposed route option would enhance the character (including quality and value) and/or special qualities of the landscape receptor, create an iconic high-quality feature and/or series of elements, or enable a sense of place to be created or enhanced.
Large	Adverse: The proposed route option would be at considerable variance with the character (including quality and value) and/or special qualities of the landscape receptor, degrade or diminish the integrity of a range of characteristic features or elements, or damage a sense of place. Beneficial: The proposed route option would enhance the character (including quality and value) and/or special qualities of the landscape receptor, create an iconic high-quality feature and/or series of elements, or enable a sense of place to be created or enhanced.
Moderate	Adverse: The proposed route option would noticeably alter the character (including quality and value) and/or special qualities of the landscape receptor, have an adverse effect on characteristic features or elements, or diminish a sense of place. Beneficial: The proposed route option would improve the character (including quality and value) or special qualities of the landscape receptor, enable the restoration of characteristic features and elements partially lost or diminished by inappropriate management or development, or enable some sense of place.
Slight	Adverse: The proposed route option would not quite fit the character (including quality and value) and/or special qualities of the landscape receptor, be at variance with characteristic features and elements, or detract from a sense of place. Beneficial: The proposed route option would complement the character (including quality and value) and/or special qualities of the landscape, maintain or enhance characteristic features and elements, and enable some sense of place to be restored.

Significance	Criteria
Neutral	The proposed route option would maintain the character and/or special qualities of the landscape receptor, blend in with characteristic features and elements, and enable a sense of place to be retained.

Community Objectives

12.2.26 At an early stage in the A9 Co-Creative Process, the Birnam to Ballinluig A9 Community Group generated community objectives. The seven objectives are presented in Volume 1, Part 3 – Environmental Assessment (Chapter 7: Overview of Environmental Assessment) and cover a wide range of topics but focus predominantly on environmental issues.

12.2.27 The community objectives have been taken into consideration throughout the DMRB Stage 2 assessment process and a mapping exercise was conducted to indicate how, in the operational phase, the proposed route options could contribute to the relevant objectives. Details of how each environmental topic contributes towards achieving the community objectives is presented in *Appendix A7.1: Mapping of Community Objectives Against DMRB Stage 2 Route Options* and a summary for this chapter is presented in Section 12.6 (Summary of Route Options Assessment).

Limitations to Assessment

12.2.28 The assessment was based on desk-based and field assessments, taking account of indicative conceptual landscape mitigation proposals (Figures 12.4 to 12.7), to enable comparison of the proposed route options. The conceptual mitigation proposals have not been developed in detail and are likely to be subject to change following further design development at DMRB Stage 3. A more detailed survey and assessment would be carried out at DMRB Stage 3, following the selection of the Preferred Route Option and development of detailed mitigation proposals.

12.3 Baseline Conditions

12.3.1 The baseline conditions presented below include a description of the national and regional legislative and planning policy background which have been considered as part of this assessment to be relevant to the proposed route options in addition to identification and description of the landscape resource within the study area to the proposed route options.

Landscape Receptors

12.3.2 The landscape resource within the study area likely to be affected by the proposed route options includes the following receptors:

- landscape character;
- landscape and landscape related designations;
- landscape elements and features; and
- settlement and built elements.

12.3.3 The baseline conditions to these receptors are described below.

Landscape Character

12.3.4 Landscape character units within the study area have been defined by Jacobs following a review of NatureScot, Landscape Character Assessment in Scotland web page and Landscape Character Types Map and Descriptions (2020) and the A9 Dualling SEA. The extents of these landscape character units across the study area and its surrounds are shown on Figure 12.1 in addition to NatureScot Landscape Character Types (LCTs).

12.3.5 Of the landscape character units identified in the region, four Local Landscape Character Areas (LLCAs) have been identified as containing elements of the proposed route options. These LLCAs comprise:

- Lowland River Corridor: Strath Tay LLCA.
- Strath Tay: Lower Glen LLCA;
- Strath Tay: Dunkeld and Birnam LLCA (Settlement); and
- Strath Tay: Mid Glen LLCA;

12.3.6 Direct, physical impacts, arising from the proposed route options on features which contribute to the character of the landscape, would occur as a direct result of the construction and operation of the proposed route options. Indirect effects would be experienced from LCTs within the 5km study area as a result of views of the proposed route options. On the basis of fieldwork and desk study, it is not considered that these perceived changes would have a significant effect upon the perception of the qualities and features which define LCTs not directly affected by the proposed route options. This is because the distinctive qualities and key features of these LCTs would remain identifiable and their integrity would be retained. Therefore, only those LLCAs that could experience both physical and visual effects as a result of the proposed route options have been considered further.

Local Landscape Character Areas

Lowland River Corridor: Strath Tay LLCA

12.3.7 The southern part of the proposed route options between ch0 and ch850 lies within the westernmost end of the Lowland River Corridor: Strath Tay LLCA.

12.3.8 The key features of the LLCA are summarised below:

- the lower part of the Strath Tay corridor is primarily underlain by sandstones, and the river therefore becomes more meandering than in its upper reaches, occupying a wide, flat farmed floodplain near Murthly;
- igneous intrusions result in occasional falls and rapids, and these along with weirs and mills are found across the valley;
- woodland is an essential component of the LLCA, comprising a combination of semi-natural woodland, forestry, farm woodlands, field boundary trees and the policy woodlands surrounding Murthly Castle. Deciduous woodland is found on steep slopes of the inner river valley, increasing a sense of enclosure and limiting visibility of the river from the wider landscape; and
- a network of hedges and hedgerows form features in the landscape, extending the variety and texture of the strath towards the lowland hills.

12.3.9 South of the river, the existing A9 cuts through the western end of the Murthly policies, with the dense woodland on either side generally containing views. Visibility along the Old Military Road to the north of the river is also often constrained by woodland, with occasional more open aspects. When trees are not in leaf, there are fleeting views east towards fields backed by woodland and wooded slopes.

Strath Tay: Lower Glen LLCA

12.3.10 The majority of the existing A9 and the proposed route options between ch850 and ch8280 are located within the Strath Tay: Lower Glen LLCA. The LLCA comprises a glaciated valley profile covered by extensive semi-natural and managed estate woodland. It surrounds the Strath Tay: Dunkeld and Birnam LLCA (Settlement).

12.3.11 The key features of the LLCA are summarised below:

- a classic lower highland glen with a narrow valley and steeply sloping wooded hill sides;
- extensive broad leaved and coniferous woodland dominates and emphasises the enclosed nature of the LLCA;
- a dramatic and attractive variety of farmland and mature woodland give a rich character;
- the river is frequently visible and gently meanders with glacial-fluvial deposits a feature, forming a relatively level floodplain; and
- well settled with a developed character due to the influence of farmland and large estates, which bring structure to the landscape.

12.3.12 Woodland is a key characteristic of the LLCA, and extensive managed areas are mainly associated with designed landscapes. Broad-leaf semi-natural woodland is found on steep slopes with coniferous areas on valley slopes. The interplay of designed landscapes, farmland and woodland make up the rich character of the LLCA, in contrast to the adjoining lowland and upland landscapes. A network of hedges, hedgerow trees and stone walls add variety and texture to the patchwork of farmland on the valley floor, although in parts, these features are fragmented and replaced with less visible timber post-and-wire fencing.

12.3.13 The LLCA is the most settled of the Highland glens, and historical communication routes to the Highlands can be found, including General Wade's Military Road. Roads and the Highland Main Line railway follow a similar course to these historical routes, including the existing A9. The existing A9 is set towards the glen and woodland and roadside vegetation reduces visibility beyond the immediate road corridor, with the exception of the River Tay crossing, where it appears as a prominent feature.

12.3.14 From within the study area, particularly from the edges of settlements and parallel designated paths and roads, there are views to vehicles on the existing A9, although these views are limited when intervening trees are in leaf. Due to the high speed of vehicles along this road, views are generally focused along the road corridor towards the Highlands and enclosed by dense woodland.

Strath Tay: Dunkeld and Birnam LLCA (Settlement)

12.3.15 The proposed route options lie within the Strath Tay: Dunkeld and Birnam LLCA (Settlement) between ch2070 and ch4300. This LLCA comprises the settlements of Dunkeld, Little Dunkeld and Birnam which lie on the flat northern and southern banks of the River Tay. The LLCA is surrounded by the hills of the Strath Tay: Lower Glen LLCA and the spectacular setting adds to the distinctive townscape character of the LLCA.

12.3.16 The key features of the LLCA are summarised below:

- Spectacular amphitheatre setting of the surrounding hills, with views framed by forest and mountains beyond;
- Settlements of Dunkeld, Little Dunkeld and Birnam, which straddle the banks of the River Tay;

- The area incorporates many fine examples of a Victorian Highland vernacular architecture and the stone built, Victorian townscapes are relatively unaltered since they were developed as Highland holiday resorts during the last half of the nineteenth century. Dunkeld is also architecturally one of the most complete 18th century country towns in Scotland; and
- Mature gardens and riverside trees contribute significantly to the townscape experience.

12.3.17 The LLCA encompasses two Conservation Areas; Dunkeld Conservation Area and Birnam Conservation Area and the former lies adjacent to Dunkeld House GDL. It also lies within the River Tay (Dunkeld) NSA.

12.3.18 The existing A9 and the Highland Main Line railway run in parallel along the southern side of the valley to the south of Birnam and views to the road from most locations within the LLCA are screened by intervening roadside vegetation. Views from the road are generally focussed on the road corridor, with the adjoining and surrounding landform, roadside trees and woodland directing views along the road and to distant wooded slopes.

Strath Tay: Mid Glen LLCA

12.3.19 The northern extents of the proposed route options lie within the Strath Tay: Mid Glen LLCA, between ch8280 and ch8420.

12.3.20 The key features of the LLCA are summarised below:

- a flat bottomed Highland strath which contains the impressive River Tay, meandering across a broad floodplain;
- enclosed by hills and generally self-contained, frequent open views across and along the glen with an attractive combination of farmland, mature woodland and heather moorland;
- agricultural use for much of the strath floor with relatively fertile farmland on the floodplain alluvium contained in large fields;
- extensive woodland with riparian trees, estate woodland and commercial forestry. The influence of large estates is often visible in the form of lines of trees giving the valley a well-wooded and structured appearance;
- settlement is spread across small villages, hamlets and farmsteads; and
- rail and road routes follow a historically important transport corridor with the experience of travelling through the open strath constrained by passes to the north and south a powerful narrative.

12.3.21 From the LLCA, the existing A9 is enclosed by landform, woodland and roadside trees and here, views from the road are focussed on the road corridor to distant wooded slopes, beyond the LLCA. When trees are not in leaf, there are fleeting views west, across the broad valley floodplain, towards wooded hills in this direction.

Landscape Elements and Features

Landform and Drainage

12.3.22 The study area is characterised by the varied landscape of the Tay valley. The River Tay meanders through the glen and is transitional in character as it flows between highland and lowland landscapes. Visibility along the glen is directed by the surrounding rugged and craggy top hills and views to the Highlands further north create a strong sense of enclosure. Valley sides are adjoined by gradually increasing hills covered in dense woodland that extend to more prominent peaks, which are characteristic of the Highlands.

12.3.23 Roads, including the existing A9 and A984, and the Highland Main Line railway run parallel to the River Tay, with the designed landscapes of Murthly Castle, Dunkeld House and The Hermitage oriented to take advantage of views to the Rivers Tay and Braan. Waterfalls and tributaries of both rivers and elevated lochs drain towards the valley and are important features that connect designed landscapes to the surrounding natural and perceived natural landscape.

Land-cover and Vegetation

12.3.24 Land-cover within the study area comprises fields and settlements in valley areas, and dense woodland within designed landscapes and on hill slopes. The enclosing landform and vegetation directs views along the strath towards rugged hills, with northbound road users of the existing A9 experiencing views towards the Highlands, particularly from the northern edge of the study area.

12.3.25 Extensive and varied woodlands and forests are found within and surrounding the study area. These areas were developed by the Forestry Commission and by private landowners including the 3rd Duke of Atholl, who created Craigvinean Forest, the first 'Big Tree Country' forest. Craigvinean Forest is located to the west of the study area and is formed by a number of woods, consisting of mainly beech and Scots pine on eastern hill slopes and rocky peaks. Widespread woodland and forest are mirrored to the east of the study area, across hill slopes and summits and surrounding elevated lochs. Much of this is designated in the Ancient Woodland Inventory (AWI), and listed as ancient or long-established, with woodland identified in the Native Woodland Survey of Scotland (NWSS) also being widespread, and the predominance and maturity of woodland along the existing A9 is a key landscape characteristic of the study area.

12.3.26 Although managed, these areas of woodland form a perceived natural setting as they have been successfully integrated into the landscape. In contrast, farmland is found along the Tay Valley and designed landscapes add to the rich character of the area. In addition to woodland and forestry, riverine and roadside vegetation creates a sense of enclosure within the study area and reduces visibility from settlements to road corridors, including the existing A9 and the A984, although seasonal changes in vegetation alters visibility of roads and traffic.

Settlement and Built Elements

12.3.27 The settlement within the study area consists of small towns, scattered individual houses and farmsteads, which are generally accessed by the existing A9 and the A984. The main settlements include Dunkeld, Little Dunkeld, Birnam and Inver, which are located on either side of the River Tay. Built and natural features connect the area to its rich history, religion and literature including Dunkeld Cathedral, which once housed the bones of St Columba and was the location of the Battle of Dunkeld, and The King's Seat on Birnam Hill, which was popularised in Shakespeare's Macbeth.

12.3.28 In addition to settlements, the main built elements within the study area are the existing A9 and A984 roads and the Highland Main Line railway. Although visible from properties and GDLs, views to/from these elements are partly screened by intervening dense vegetation.

Landscape and Landscape Related Designations

12.3.29 Landscape and landscape related designations that fall within the study area are detailed below and are shown on Figures 12.2 and 12.3, as are other designations with relevant heritage or recreational value such as Conservation Areas, Forest Parks and areas of Ancient Woodland.

River Tay (Dunkeld) National Scenic Area

12.3.30 Between the Pass of Birnam and the Tay Crossing, the existing A9 lies wholly within the River Tay (Dunkeld) NSA (Figure 12.2). The NSA is characterised by its natural and semi-natural scenery and cultural influences, where the highland features of rivers, straths and haughlands are balanced with farmland, settlements and managed woodland over hills and across policies and designed landscapes. It includes the settlements of Dunkeld and Birnam (refer to Image 12.1) and extends north to parts of Craigvinean Forest and east to include the Loch of Lowes, Loch of Craiglush, and Loch of Butterstone. The nine Special Qualities (SQs) of the NSA are identified in The Special Qualities of the National Scenic Areas, Scottish Natural Heritage Commissioned Report No.374 (2010) as follows:

1. The beauty of cultural landscapes accompanying natural grandeur;
2. The 'Gateway to the Highlands';
3. Characterful rivers, waterfalls and kettle-hole lochs;
4. Exceptionally rich, varied and beautiful woodlands;
5. The picturesque cathedral town of Dunkeld;
6. Drama of The Falls of Braan and The Hermitage;
7. Dunkeld House policies;
8. Significant specimen trees; and
9. The iconic view from King's Seat.

12.3.31 These SQs can be summarised as follows:

1. Scenic and cultural landscapes, combining and balancing managed policies, designed landscapes, forest and farmland.
2. The picturesque, cathedral town of Dunkeld is referred to as the 'Gateway to the Highlands' and from here the landscape transitions from lowland scenery to highland. This is most noticeable in winter, when low-lying areas of green and brown contrast snow covered summits beyond. Travelling north on the existing A9, road users experience the 'gateway feel' where vistas of Strath Tay open to the Highland hills
3. Rivers, lochs and waterfalls are found throughout the NSA and vary greatly, adding to the interest, atmosphere and experience of the landscape. The River Tay meanders in loops with alternating swift glides and long pools, in contrast to the turbulent and tumbling rapids and waterfalls of the River Braan.
4. Woodland within the NSA consists of a variety of tree species with different management history and age structure, with some woodland set within and adjoining areas of open field and pasture, at times allowing long range views. Notable areas of woodland within the NSA include The Hermitage woodland, Craigvinean Forest, policy woodlands at Craig a Barns and Crieff Hill and ornamental planting and policy woodlands within Dunkeld House Garden and Designated Landscape (GDL).
5. The picturesque cathedral town of Dunkeld (refer to Image 12.1) is found at the NSA's centre and its rich cultural and religious history and its setting nestled in the hills on the River Tay's north haughlands, make it a popular tourist destination.
6. Scenic views of the dramatic Falls of Braan are experienced along walks within The Hermitage GDL. Within the GDL, woodland typically restricts long distance views and hides and reveals built features including Ossian's Hall, Hermitage Bridge and Ossian's Cave.
7. Dunkeld House policies extend along the northern bank of the River Tay and make up a major portion of the NSA. It forms a significant extent of designed and managed ornamental planting and

walks and is a place that exploits the dominant views on each side of the River Tay and Braan to the coniferous woodlands and mountains beyond.

8. Specimen and ornamental trees not only add to the countryside character and visual variety, they also have historic connections to the area. Significant individual trees and tree groups include those along rivers, beech trees forming The Bishop's Walk at Dunkeld Cathedral as well as the Birnam Oak, Niel Gow's Oak and The Hermitage's Douglas Fir.
9. To the south of Dunkeld is the viewpoint at the (King's) Seat, marked by a cairn on the top of Birnam Hill. From the King's Seat, the surrounding landscape is dominated by fertile farmland and pasture on open fields contrasting woodland with views north of the glens and the Highlands. Existing views of the A9 road corridor from the King's Seat are restricted by the intervening landform and vegetation.

12.3.32 A full description of each of the individual SQs of the NSA and a detailed assessment of the predicted effects on each SQ is provided in *Appendix A12.1: Assessment of Predicted Potential Impacts and Effects on the Special Qualities of the River Tay (Dunkeld) National Scenic Area*. A summary of the predicted effects is provided in Section 12.4 (Potential Impacts) and Section 12.6 (Summary of Route Options Assessment). In addition to the assessment provided in *Appendix A12.1: Assessment of Predicted Potential Impacts and Effects on the Special Qualities of the River Tay (Dunkeld) National Scenic Area,* the potential effects on the experience of the 'Gateway to the Highlands' by users of the A9 is also discussed in Volume 1, Part 3 – Environmental Assessment (Chapter 13: Visual and *Appendix A13.2: View from the Road*).

Image 12.1: Aerial photograph of Dunkeld, Dunkeld Bridge, Little Dunkeld, the River Braan crossing and A9 road corridor at the existing Dunkeld Junction

Murthly Castle GDL

12.3.33 The north-western extents of Murthly Castle GDL are located within the study area (Figure 12.2). The Highland Main Line railway and the existing A9 run through the GDL. The main entrance to the castle grounds is from the B9099 in the east, with another entrance from the existing A9 road corridor near Ringwood, providing access to a few private properties within the western part of the estate. Although the estate is privately owned, publicly accessible Core Paths are located throughout and towards the periphery of the designation, and there are fragmented views to the existing A9 from paths along the western side of the estate.

12.3.34 Murthly Castle GDL is renowned for its woodland and was originally part of Birnam Wood. The designation consists of over 162ha of amenity woodland including the Muir of Thorn in the south, which forms the setting of the central listed buildings. The garden between the Castle and the Chapel has a strong north-to-south axial design and some of the oldest trees in the estate are found in the east, along the banks of the River Tay. The extent of policy woodlands along the Tay Valley, and the range, age and size of trees within them make Murthly Castle GDL particularly notable for its scenic value.

12.3.35 The parkland was first set out in the 17th/18th century and is divided into two main parts by the Castle and the lime and yew avenue (the Avenue) in an almost north/south division. Throughout the parkland several other avenues were created, some of which remain significant features, such as the oak avenue and the cedar avenue which runs along the western drive close to the existing A9 (Photograph 12.1). The Castle is located on a knoll in the centre of the GDL and, although surrounded by woodland, long views can be obtained from it towards the foothills of the Highlands.

Photograph 12.1: The Western Drive cedar avenue, Murthly Castle GDL

12.3.36 Although located within the western part of the policies, the existing A9 has a limited influence on the key features of the GDL as visibility to the existing road corridor is fully or partially screened by intervening woodland and roadside vegetation. From the GDL, views are dominated by the parkland and surrounding hills covered in woodland and plantation.

12.3.37 An assessment of the historic aspects of the GDL is provided in Volume 1, Part 3 – Environmental Assessment (Chapter 14: Cultural Heritage).

The Hermitage GDL

12.3.38 The Hermitage GDL is located on the River Braan, south-west of Dunkeld (Figure 12.2). This 18th century rugged picturesque landscape extends over 29ha and was built as part of the 'sublime' experience of the time. The Hermitage was originally designed as part of the Dunkeld Estate but is now separate from it.

12.3.39 The designation consists of buildings, paths, woodland and viewpoints within the dramatic Highland gorge. The Category A- and B-listed structures of Ossian's Hall, Hermitage Bridge and Ossian's Cave are set within woodland, which creates a great sense of seclusion and enclosure, and contains fine stands of Douglas firs, including of one Britain's tallest trees. In addition to woodland within the designation, the afforested slopes of Craigvinean Forest and Birnam Wood also contribute to the setting of these features and the overall GDL.

12.3.40 The existing A9 is located towards the eastern edge of the GDL but has no effect on the key features of the designation, which are located towards the River Braan. Views are generally internal and those to Ossian's Hall, Hermitage Bridge and Ossian's Cave are accompanied by the sound of the Falls of Braan (Photograph 12.2) and dominate the experience along woodland walks. The scenic value afforded by the woodlands of the GDL to the wider landscape of the NSA, that it sits within, is visually restricted by its secluded valley setting.

Photograph 12.2: Falls of Braan at Ossian's Hall, The Hermitage GDL

12.3.41 An assessment of the historic aspects of the GDL (Historic Landscape Type 20) is provided in Volume 1, Part 3 – Environmental Assessment (Chapter 14: Cultural Heritage).

Dunkeld House GDL

12.3.42 Dunkeld House is an 18th century formal designed landscape, which was informalised in the 19th century. The GDL lies to the west of Dunkeld and is accessed from the A923 in the east as well as via National Cycle Network (NCN) Route 77 (NCR 77) and designated paths (Photograph 12.3), which run in a general east-west direction through the designation (Figure 12.2).

12.3.43 Listed and other architecturally notable buildings/structures are scattered across the GDL and include Dunkeld House (which is currently managed as a hotel), Dunkeld Cathedral, the Terraced Walled Garden and the East Grotto. Buildings are generally orientated to take advantage of views to the River Tay and the policies, with vantage points also found at Bishop's Hill and Stanley Hill. The GDL extends north and west to woodland including that on Craig a Barns and at King's Seat Wood. In addition to woodland, the River Tay is important to the setting of Dunkeld House, which is positioned to take advantage of views towards it. Some of the oldest larch trees in Britain are found within the woodland, and the policies also contain some fine parkland and other specimen trees.

Photograph 12.3: Cycle path/core path, Dunkeld House GDL

12.3.44 The existing A9 is located to the south and west of the GDL, and there are fragmented views to the road corridor from the western extents including from designated paths, although these would be reduced when trees are in leaf. Views from the GDL are generally of the policies and the River Tay and are dominated by the hills enclosing the Tay and Braan valleys.

12.3.45 An assessment of the historic aspects of the GDL is provided in Volume 1, Part 3 – Environmental Assessment (Chapter 14: Cultural Heritage).

Tay Forest Park

12.3.46 Craigvinean Forest, which forms part of the Tay Forest Park, lies immediately to the west of the existing A9 corridor and covers the hill slopes flanking Strath Tay. Craigvinean was one of the first 'Big Tree Country'[2] forests in Perthshire; one of several planted by the Dukes of Atholl and is one of Scotland's oldest managed forests. The forest includes numerous trails and some viewpoints overlooking Strath Tay.

[2] Perthshire is known as 'Big Tree Country' by virtue of its woodlands which include *'more champion trees than anywhere else in the UK'* and having some of the largest trees in Britain (http://www.perthshirebigtreecountry.co.uk accessed 13/08/18).

12.3.47 Within the study area, the Tay Forest Park extends from the Craigvinean Forest across The Hermitage GDL and south of the settlements of Inver and Little Dunkeld (Figure 12.2). The existing A9 is located within approximately 500 metres of the Tay Forest Park. Views to the forest park are currently restricted by dense woodland within the designation and intervening roadside vegetation and embankment, with more open views to wooded hill slopes at and on approach to the Tay Crossing. Visibility of the existing A9 from the forest park is mainly limited to a few clearings within the forest, with the majority of the trails enclosed by woodland.

12.3.48 Considering the limited effect on woodland within the forest park as a whole, this designation is not considered further in this chapter.

Conservation Areas

12.3.49 Birnam and Dunkeld Conservation Areas (CAs) both lie within the study area. PKC has produced an appraisal for Dunkeld CA (Image 12.2) to act as supplementary guidance, but (at the time of assessment) had not yet published the appraisal for Birnam CA. The locations of both Conservation Areas are illustrated on Figure 12.2 and shown in greater detail on Figure 12.3.

12.3.50 Assessment of the historic aspects of the Conservation Areas is provided in Volume 1, Part 3 – Environmental Assessment (Chapter 14: Cultural Heritage).

Dunkeld Conservation Area

Image 12.2: Aerial photograph illustrating the extent of the Dunkeld Conservation Area

12.3.51 The town of Dunkeld is dramatically sited in a bowl-shaped valley on the River Tay, to the north of the river and surrounded by the steep, wooded slopes of Craig a Barns, Crieff Hill, Newtyle Hill, Birnam Hill and Craig Vinean. Much of the town lies within the Dunkeld CA boundary.

12.3.52 The Dunkeld CA Appraisal states that, due to the town's historical importance as an early ecclesiastical centre of Scotland, the rich and varied townscape character, the A-listed buildings of Dunkeld Cathedral and Thomas Telford's Dunkeld Bridge, the Dunkeld House Gardens and Designed Landscape and the magnificent setting comprising a natural amphitheatre of woodlands and forested hills, the CA is assessed as outstanding.

12.3.53 The River Tay separates the main area of the CA from the existing A9, which lies to the south and west. As the CA is set towards the river and due to dense intervening vegetation, views from the designation to the existing A9 are limited.

Birnam Conservation Area

Image 12.3: Aerial photograph illustrating the extent of the Birnam Conservation Area

12.3.54 Birnam is located on the southern bank of the River Tay to the south of Dunkeld and is backed by the steep Birnam Hill to the south and the hills of Craig a Barns, Crieff Hill and Newtyle Hill to the north. These hills and the banks of the River Tay are covered by dense mature woodland, and this scenic setting makes a significant contribution to the character and special qualities of the CA.

12.3.55 Birnam CA (Image 12.3) is bound to the north by the southern bank of the River Tay, to the east by the Birnam Caravan Park, to the south by Birnam Hill and to the west by the Inchewan Burn. The CA is bisected by the existing A9, the two sections of the CA being 'linked' by Birnam Glen. The CA incorporates many notable Victorian listed buildings, including Birnam House Hotel, St Mary's Episcopal Church and Dunkeld & Birnam Station, in addition to mature trees. Some of these trees are situated on either side of the existing A9.

12.3.56 From southern parts of the CA, the existing A9 and vehicles on it are visible, although these views would vary depending on when trees are/are not in leaf. From the northern section of the CA views of the existing A9 and associated traffic are limited due to intervening buildings and vegetation.

12.3.57 All trees within the conservation area are protected from pruning, lopping and felling.

Tree Preservation Orders (TPOs)

12.3.58 There are no TPOs recorded within 1km of the existing A9 in the PKC area (PKC online data enquiry, January 2020). However, the Council does have the right to impose a TPO in order to protect trees within a conservation order if a tree, or trees, are considered by PKC to be of substantial merit to the conservation area.

12.4 Potential Impacts and Effects

12.4.1 This section describes the potential impacts and effects on the physical landscape and landscape character for each of the proposed route options during construction and operation. Potential impacts reported are those in the absence of landscape planting mitigation but do include consideration of some aspects that influence the landscape such as the grading out of embankments or alignment of the proposed route option to reduce woodland loss. These early 'embedded' mitigation measures are incorporated within the design of each of the proposed route options as presented and assessed below.

12.4.2 Further assessment, taking account of indicative conceptual landscape mitigation proposals (Figures 12.4 to 12.7) described in Section 12.5 (Potential Mitigation), in addition to the 'embedded' mitigation measures is provided in the Summary of Route Options Assessment (Section 12.6).

12.4.3 Potential impacts and effects are first identified which are common to all the proposed route options, followed by those which are specific to the individual proposed route options.

Construction

12.4.4 The construction activities associated with road schemes generally cause temporary adverse landscape impacts. All the proposed route options are likely to result in potential impacts on the landscape resource during construction as a result of the following typical activities:

- removal of roadside woodland and scrub vegetation;
- loss of embankments and rock outcrops;
- vehicles moving machinery and materials to and from the site;
- machinery, potentially including heavy excavators and earth-moving plant;
- exposed bare earth over the extent of the proposed works;
- structures, earthworks, road surfacing and ancillary works during construction;
- temporary site compound areas including site accommodation and parking (note that Option ST2A also requires a concrete batching plant and mud plant);

- temporary soil-storage heaps and stockpiles of construction materials;
- lighting associated with night-time working and site accommodation;
- traffic congestion and queuing during work to tie new road with existing road;
- temporary works associated with bridge construction operations; and
- traffic management measures.

12.4.5 In general terms the potential for the greatest adverse landscape impacts during the construction period are likely to occur when major structures such as bridges, retaining walls and/or junctions and the associated earthworks are being erected or carried out. These would include:

- The proposed junction, slip roads and associated earthworks in the vicinity of the western entrance to Murthly Castle, south-east of Birnam (Option ST2A only).
- The proposed junctions, underpasses/overpasses and associated retaining walls and earthworks south of Birnam in the vicinity of the existing junction of the B867 with the A9 (all proposed route options except ST2A).
- The proposed cut and cover tunnel requiring more extensive earth-moving operations and associated piling works, as well as temporary realignment of the A9 adjacent to Dunkeld & Birnam Station (Option ST2A only).
- The proposed junctions including underpasses/overpasses, bridge, slip roads and associated earthworks and retaining walls at Little Dunkeld (all proposed route options).
- Offline widening and realignment of the A9 plus all associated earthworks between Inver and Inver Wood (all proposed route options).
- The proposed junction arrangement, underpass, retaining walls and earthworks at Inver Wood (Dalguise).
- Online widening, bridge (Tay Crossing) and earthworks between Inver Wood and the end of the proposed route options.

Operation

12.4.6 The potential landscape impacts and effects of the proposed route options are detailed in Tables 12.8-12.10 below. Mitigation measures 'embedded' within the design of the proposed route options, include alignment and use of retaining structures to reduce woodland loss. All potential impacts and their potential resulting effect are considered adverse unless otherwise stated.

Table 12.8: Potential Landscape Impacts and Effects on Local Landscape Character Areas (with 'Embedded' Mitigation)

Route Option	Description of Potential Impact	Potential Effect
Lowland River Corridor: Strath Tay LLCA (start of proposed route options at ch0 - ch850)		
Value: National (extents include River Tay (Dunkeld) NSA and Murthly Castle GDL) **Susceptibility:** Medium **Sensitivity:** Medium		
Option ST2A	**ch0 to ch400** ▪ Widening of the A9 from the start of the scheme (ch0) at Pass of Birnam to approx. ch400, with associated new embankment on the southbound side would result in the loss of roadside trees and increased prominence of the road, opening up short range views of traffic from farmland within Murthly GDL and the Murthly Castle western access road, though the GDL would remain largely enclosed by existing woodland. **ch400 to ch850** ▪ Widening of the A9, junction slip roads and associated cuttings and embankments in addition to the realigned Murthly Castle western access road would result in the loss of mature conifer plantation woodland, open up the enclosed, heavily wooded character of the existing A9 corridor at this location, increasing the prominence of road infrastructure and earthworks within the LLCA, although new slip road embankments would enclose the A9 main carriageway reducing its visibility. New overbridge would further increase the prominence of road infrastructure and locally interrupt visibility along the route corridor. ▪ Introduction of a proposed SuDS feature and associated earthworks would result in the loss of an area of existing woodland and alter natural landform adjacent to the southbound slip road at ch500.	**Magnitude:** Minor **Significance:** Slight
Option ST2B	**ch0 to ch400** ▪ As Option ST2A. **ch400 to ch850** ▪ Widening of the A9 on both sides from ch400 to ch850, with new embankment on the southbound side would result in the loss of roadside trees and increased prominence of the road within the LLCA. **ch850** ▪ The underbridge, associated cuttings, realigned Murthly Castle access road and introduction of a proposed SuDS feature on the southbound side at ch800 would result in the loss of woodland, opening the enclosed, heavily wooded character of the existing A9 and locally altering the landform at this location.	**Magnitude:** Minor **Significance:** Slight
Option ST2C	**ch0 to ch400** ▪ As Option ST2A.	**Magnitude:** Minor **Significance:** Slight

Route Option	Description of Potential Impact	Potential Effect
	ch400 to ch850 ▪ As Option ST2B. **ch850** ▪ As Option ST2B.	
Option ST2D	**ch0 to ch400** ▪ As Option ST2A. **ch400 to ch850** ▪ As Option ST2B. **ch850** ▪ As Option ST2B.	**Magnitude:** Minor **Significance:** Slight
Strath Tay: Lower Glen LLCA (ch850 - ch8280)		
Value: National (extents include River Tay (Dunkeld) NSA, Murthly Castle, Dunkeld House and The Hermitage GDLs) **Susceptibility:** Medium/High **Sensitivity:** High		
Option ST2A	**ch850 to ch2150** ▪ Widening of the A9, junction slip roads and associated cuttings and embankments between ch850 and ch1200 would result in the loss of mature conifer plantation woodland and open up the enclosed, heavily wooded character of the existing A9 corridor at this location, increasing the prominence of road infrastructure and associated earthworks within the LLCA. ▪ Widening between ch1200 and ch1800 would be largely in cutting, resulting in the loss of woodland including mixed roadside planting, large mature copper beech avenue trees (at Ring Wood, northbound ch1350 to ch1550) and coniferous forestry plantation (the remains of which may be prone to windthrow), and an increase in the prominence of road infrastructure and associated earthworks within the heavily wooded LLCA. ▪ Online widening of the A9 between approx. ch1800 and ch2150, the associated cutting deepening as the carriageway level drops and enters the cut and covered/tunnelled section, resulting in loss of roadside woodland. ▪ Revised arrangement of the B867 which would remain at-grade. The formation of new cuttings and realignment of the road would alter landform and result in the loss of woodland on the northbound side. ▪ Introduction of the proposed SuDS feature and associated earthworks would result in the loss of an area of existing mature woodland and alter natural landform adjacent to the southbound carriageway at ch1950.	**Magnitude:** Moderate **Significance: Moderate**

Route Option	Description of Potential Impact	Potential Effect
	ch2150 to ch4000 ▪ Tunnel portals and wing-walls locally prominent within road corridor. ▪ Cut and cover section of the A9, the existing A9 grubbed up, resulting in a reduced prominence of road infrastructure and increased tranquillity due to removal of A9 traffic within the LLCA to the south of Birnam and Little Dunkeld, between ch2150 and ch3780. Proposed grading out of the ground above the tunnel to tie-in with the surrounding topography would also help to reintegrate the route of the existing A9 into the landscape. ▪ Loss of roadside trees within construction footprint on south side of the A9, resulting in a more open character along the route corridor. ▪ New access road south of the Highland Main Line railway with sections of cutting connecting onto the A822 (Old Military Road), resulting in the loss of areas of mature woodland, including some AWI. ▪ Loss of a small area of woodland and pasture as a result of the introduction of the proposed SuDS feature and associated earthworks between the new access road and the Highland Main Line railway at ch3500. ▪ Culverting of Inchewan burn would alter natural form of the watercourse. **ch4000 to ch4800** ▪ New at-grade, five-spur elongated roundabout (ch4100), realigned side roads and associated cuttings and embankments and construction of retaining walls would alter landform and result in the loss of existing woodland and roadside trees and open up the enclosed, wooded character of the existing A9 corridor and increase the prominence of road infrastructure at this location to the south of the existing A9. ▪ Loss of small areas of woodland and builder's supply yard/garden space as a result of the introduction of the proposed SuDS feature and associated earthworks adjacent to the northbound carriageway between ch4100 and ch4300. ▪ Widened crossing of the River Braan (ch4350) and associated embankments would result in the loss of roadside trees and woodland and increase the prominence of road infrastructure in the landscape. **ch4800 to ch6000** ▪ From Inver (approx. ch4800) to ch6000, the widening along the northbound and southbound carriageways and new cuttings and embankments would result in the loss of mature roadside trees including AWI/NWSS woodland and agricultural land. ▪ Introduction of the proposed SuDS feature, and associated earthworks would result in the loss of an area of scrub and mature woodland and alter natural landform adjacent to the northbound carriageway between ch4800 and ch4900. ▪ Loss of roadside woodland and pasture fields due to widening with cutting and large-scale embankment to the southbound side between ch5000 and ch5600, affecting landform and increasing the prominence of road infrastructure along the river corridor, including at Neil Gow's Oak, located along the river bank to the north at ch5300. ▪ New large-scale retaining wall associated with the railway crossing and approaches on the southbound side from ch5820 to ch6050 would reduce the amount of embankment required but would have a visual impact on the road corridor, increasing the prominence of the road infrastructure. Introduction of the proposed SuDS feature and associated earthworks would alter natural landform and result in the loss of an area of existing mature woodland adjacent to the northbound carriageway between ch5800 and ch5950.	

Route Option	Description of Potential Impact	Potential Effect
	ch6000 to ch8280 ▪ From ch6000 to Inver Wood (ch6800), off-line realignment to the west, with extensive cuttings into the wooded hillside, would alter the character of the road corridor landscape, with loss of mature dense conifer woodland (potentially increasing risk of windthrow in remaining areas) and introduction of large areas of rock cutting. ▪ Road corridor and traffic would become considerably more prominent in the landscape as a result of widening, increased vertical alignment, large-scale visually prominent cuttings on the northbound side and embankments on the southbound side. However, visibility of the route from the wider landscape would remain limited by existing woodland and topography. ▪ North of Inver Wood the re-aligned A9, the new Dalguise Junction and realigned B898 plus associated cuttings along the northbound side would result in the loss of large areas of mature, dense coniferous AWI/NWSS woodland and an existing agricultural field. The road infrastructure would become more prominent in this area, with the widened A9, junction slip roads, the realigned B898, the new underbridge and associated roundabout. ▪ Introduction of a proposed SuDS feature and associated earthworks would result in the loss of an area of pasture and alter natural landform adjacent to the southbound carriageway at ch7100. ▪ New/extended railway bridge (ch7130 to ch7350) would potentially be more visually prominent in the landscape than the existing structure due to the more skewed angle at which the route would cross it and the larger retaining structure required. ▪ Widening from ch7200 to ch8280 on the southbound side, including the widened River Tay bridge crossing with associated embankments, would result in loss of some roadside and mature NWSS riparian woodland. ▪ North of the River Tay crossing large-scale, cuttings on the southbound side from ch7900 to ch8280 would result in the loss of an area of low-lying scrub and a number of mature trees along the western edge of mixed species AWI forest would increase the prominence of road infrastructure in the landscape. ▪ Introduction of the proposed SuDS feature and associated earthworks would result in the loss of an area of existing mature woodland and alter natural landform adjacent to the northbound carriageway between ch7900 and ch8000.	

Route Option	Description of Potential Impact	Potential Effect
Option ST2B	**ch850 to ch1600** ▪ The underbridge associated cuttings and realigned Murthly Castle access road, online widening of the A9 and offline routing in combination with associated earthworks would result in the loss of woodland along the road corridor, opening the enclosed, heavily wooded character of the existing A9 and locally altering landform at this location. ▪ Offline routing of the A9 between ch1200 and ch1600 largely in cutting resulting in the loss of woodland (including mixed roadside planting, large mature beech avenue trees (at Ring Wood, northbound ch1350 to ch1550) and coniferous forestry plantation, the remains of which are likely to be prone to windthrow) and increase in the prominence of road infrastructure and associated earthworks within the heavily wooded LLCA. **ch1600 to ch2400** ▪ Junction slip-roads, realigned Perth Road/B867 and associated cuttings and embankments would open up the enclosed, heavily wooded character of the existing A9 corridor at this location and the road infrastructure and earthworks would become more prominent (note that while conifers have been felled, and broadleaf trees retained, it is anticipated that tree planting would be undertaken in absence of dualling). ▪ From ch1700 to ch2100 the widened A9 and associated cuttings and embankments would alter landform and result in the loss of mature mixed broadleaved and coniferous AWI woodland on the northbound side at Ring Wood (part of the Murthly Castle GDL), with potential for windthrow in the remaining woodland. ▪ New southbound merge slip road would result in removal of AWI woodland between ch1800 and ch2200. **ch2400 to ch2800** ▪ Online widening with the formation of new embankments would alter the existing landform and lead to the removal of mature roadside trees on the northbound side of the existing A9. **ch2800 to ch4000** ▪ The widening of the A9, its lowering so as to pass under the new parking facility at Dunkeld & Birnam Station, retaining walls and cuttings would result in the loss of relatively small/modest areas of mature roadside woodland and alterations to the existing landform. ▪ The underpass structure including large-scale retaining walls between approx. ch3150 and ch3500 and the replacement car park (approx. ch3260 to ch3420) would have an urbanising influence on the road corridor at this location. ▪ Loss of small area of woodland and pasture as a result of the introduction of the proposed SuDS feature and associated earthworks between the new access road and the Highland Main Line railway at ch3500. **ch4000 to ch8280** ▪ As Option ST2A	**Magnitude:** Major **Significance: Large**

Route Option	Description of Potential Impact	Potential Effect
Option ST2C	**ch850 to ch2800** ▪ As Option ST2B **ch2800 to ch3500** ▪ Widening and new embankments along both sides of the road alongside Birnam, resulting in the loss of roadside trees and increased prominence of the road. The proposed new road would be considerably closer to the Category A listed Dunkeld & Birnam Station building, adversely affecting its landscape setting. ▪ New underpass structure would have a very localised urbanising impact on landscape character on both sides of the A9 and lifts and/or ramps to provide access to platform level would affect the character of the station. ▪ New bridge at Birnam Glen would result in loss of woodland and increase the prominence of road infrastructure. **ch3500 to ch4800** ▪ New junction (approx. ch4000), slip roads, realigned side roads and associated cuttings and embankments would result in the loss of existing woodland and roadside trees and open up the enclosed, wooded character of the existing A9 corridor at this location and the road infrastructure including bridge and retaining walls would become more prominent. ▪ Vertical alignment of mainline from ch3500 to ch4000 would be up to 9.5m above existing grade, closer to the pre-existing ground level prior to construction of the existing A9, which is in cutting. This would potentially improve the fit with the natural topography of the area south of Little Dunkeld (where the existing road is situated within a cutting) but would increase the prominence of the road and its influence on the neighbouring areas. ▪ New River Braan bridge crossing (ch4350) would be wider and significantly higher (up to 13m) than the existing bridge, with loss of riparian woodland and impact on the character of the river corridor. Large embankments west of the river crossing would be prominent in the relatively flat valley floor and require removal of newly planted woodland. ▪ Introduction of the proposed SuDS feature would result in the loss of an area of woodland and the builder's supply yard/garden space at ch4200. ▪ New cuttings for the northbound diverge slip road to the Dunkeld Junction would remove the existing screening bund between the A9 and the Highland Main Line railway, which would open up the enclosed, wooded character of the A9 corridor and create additional views of the railway. ▪ Realignment of local access road and associated embankment along the westbound side from the A822 (Old Military Road) to Inver Caravan Site and Inver Bridge would result in the loss of a band of deciduous AWI woodland currently screening the existing railway line. A contiguous piled retaining wall 6-10m in height would limit the scope for replanting at this location. **ch4800 to ch8280** ▪ As Option ST2A	**Magnitude:** Major **Significance: Large**

Route Option	Description of Potential Impact	Potential Effect
Option ST2D	**ch850 to ch2800** ▪ As Option ST2B **ch2800 to ch3500** ▪ As Option ST2C **ch3500 to ch4000** ▪ Road widening and new cuttings for the northbound carriageway on the approach to the new Dunkeld Junction roundabout would potentially open up the enclosed, wooded character of the A9 corridor and create additional views of the railway. **ch4000 to ch8280** ▪ As Option ST2A	**Magnitude:** Moderate **Significance: Moderate**
Strath Tay: Dunkeld and Birnam LLCA (Settlement) (ch2070 – ch4300)		
Value: National (extents include River Tay (Dunkeld) NSA and Dunkeld House GDL) Susceptibility: **Medium** Sensitivity**: Medium/High**		
Option ST2A	**ch2070 to ch4000** ▪ Introduction of a SuDS feature and associated earthworks at ch2250 would alter natural landform and result in the loss of an area of existing mature woodland at the south-east tip of Birnam. ▪ New access road and embankments between Perth Road and the Sewage Works would result in impacts on natural valley floor landform and the loss of broadleaved AWI woodland, opening views towards the junction from the river corridor. ▪ Cut and covered/tunnelled section of the A9, the existing A9 grubbed up, resulting in a reduced prominence of road infrastructure and increased tranquillity due to removal of A9 traffic within the LLCA to the south of Birnam and Little Dunkeld, between ch2150 and ch3780. ▪ Loss of roadside trees within the construction footprint on the southbound side of the A9, resulting in a more open character along the route corridor. ▪ New parking facility at Dunkeld & Birnam Station (between ch3260 to ch3420) and extension to Station Road, resulting in the loss of two relatively small areas of mature trees at the southern edge of the settlement. ▪ Culverting of Inchewan burn would alter natural form of the watercourse and introduce additional retaining structures along the course of the burn north of the A9. ▪ Proposed cuttings at the north end of the proposed tunnel (ch3730-ch3900) would result in the loss of roadside woodland and open views of the widened mainline and associated traffic from the adjoining residential area to the immediate north.	**Magnitude:** Minor **Significance:** Slight

Route Option	Description of Potential Impact	Potential Effect
	ch4000 to ch4300 ▪ New at-grade, five-spur elongated roundabout (ch4100), realigned side roads and associated cuttings and embankments and construction of retaining walls would alter landform and result in the loss of existing roadside woodland along the southern edge of the settlement and increase the prominence of road infrastructure to the north of the existing A9 at this location.	
Option ST2B	**ch2070 to ch2400** ▪ The B867 (and Sustrans National Cycle Network (NCN) Route 77) would connect with the Perth Road at the south of Birnam via a new underpass at ch2200, with large new cuttings proposed on both sides of the Perth Road altering the landform and resulting in the loss of an area of broadleaved woodland and a change in landform immediately north of the underpass, removing an area of rock outcrop at the existing junction. ▪ Introduction of a SuDS feature and associated earthworks at ch2250 would alter natural landform and result in the loss of an area of existing mature woodland at the south-east tip of Birnam. ▪ New access road and embankments between Perth Road and the Sewage Works would result in impacts on natural valley floor landform and the loss of broadleaved AWI woodland, opening views towards the junction from the river corridor. **ch2400 to ch2800** ▪ Online widening with the formation of new embankments would alter the existing landform and lead to the removal of mature roadside trees along the southern edge of the settlement. New steepened embankment slopes on the southbound side from ch2450 to ch2770 would result in a more open character and traffic would be more prominent in views from the northeast. **ch2800 to ch4300** ▪ The widening of the A9, its lowering so as to pass under the new parking facility at Dunkeld & Birnam Station, retaining walls and cuttings would result in the loss of areas of mature roadside woodland and alterations to the existing landform along the southern edge of the settlement. **ch4000 to ch4300** ▪ As Option ST2A	**Magnitude:** Minor **Significance:** Slight
Option ST2C	**ch2070 to ch2800** ▪ As Option ST2B **ch2800 to ch3500** ▪ Widening and new embankments along both sides of the road alongside Birnam, resulting in the loss of roadside trees and increased prominence of the road. ▪ Road widening and lengthening of the minor road underpass at Birnam Glen (also Core Path DUNK/11/15 and NCN Route 77 and running alongside Inchewan Burn) would increase the sense of separation between the two areas of Birnam either side of the A9 and between the main part of the village and the countryside.	**Magnitude:** Moderate **Significance: Moderate**

Route Option	Description of Potential Impact	Potential Effect
	▪ Construction of new Dunkeld & Birnam Station carpark would locally change townscape character as a result of the removal of modern business unit buildings and existing trees, opening up views of the dualled A9 from the adjoining residential area and increasing area of hard surfacing. ▪ New underpass structure would have a very localised urbanising impact on landscape character on both sides of the A9 and lifts and/or ramps to provide access to platform level would affect the character of the station. ▪ New bridge at Birnam Glen would result in loss of woodland and increase the prominence of road infrastructure. ▪ Introduction of a proposed SuDS feature and associated earthworks to the southeast of the existing industrial units would result in the loss of an area of existing mature woodland adjacent to the southbound carriageway at ch3250, opening up views of the dualled A9 from the adjoining residential area. **ch3500 to ch4300** ▪ New junction (approx. ch4000), slip roads, realigned side roads and associated cuttings and embankments would result in the loss of existing woodland and roadside trees and open up the enclosed, wooded character of the existing A9 corridor at this location. The road infrastructure including bridge and retaining walls would become more prominent in views from the adjoining settlement. ▪ Vertical alignment of mainline from ch3500 to ch4000 would be up to 9.5m above existing grade, closer to the pre-existing ground level prior to construction of the existing A9, which is in cutting. This would potentially improve the fit with the natural topography of the area south of Little Dunkeld (where the existing road is situated within a cutting) but would increase the prominence of the road and its influence on the neighbouring settlement. ▪ High retaining wall along the southbound diverge slip road associated with the Braan crossing would affect the character of the neighbouring area, including the nearby Dunkeld Bowling Club and Dunkeld & Birnam Tennis Club. ▪ Introduction of a SuDS feature in Birnam Glen at ch3500 would result in the loss of woodland and alter the wooded, enclosed character of the watercourse. ▪ Three low retaining walls along the southbound merge slip-road adjacent to Little Dunkeld would alter the character of the road corridor and their construction would require removal of some garden vegetation in neighbouring properties at ch3680. ▪ New cuttings for the northbound diverge slip road to the Dunkeld Junction would remove the existing screening bund between the A9 and the Highland Main Line railway, which would open up the enclosed, wooded character of the A9 corridor and create additional views of the railway.	

Route Option	Description of Potential Impact	Potential Effect
Option ST2D	**ch2070 to ch2800** ▪ As Option ST2B **ch2800 to ch3500** ▪ As Option ST2C **ch3500 to ch4000** ▪ Road widening and new cuttings for the northbound carriageway on the approach to the new Dunkeld Junction roundabout would potentially open up the enclosed, wooded character of the A9 corridor to the immediate south of the settlement. **ch4000 to ch4300** ▪ As Option ST2A	**Magnitude:** Minor **Significance:** Slight
Strath Tay: Mid Glen LLCA (ch8280 – end of proposed route options at ch8420)		
Value: National (extents include River Tay (Dunkeld) NSA**)** Susceptibility: **Medium** Sensitivity**: Medium/High**		
Option ST2A	**ch8280 to ch8420** ▪ Large-scale, cuttings on the southbound side from ch8280 to the end of the proposed route options (ch8420) would result in the loss of an area of low-lying scrub and a number of mature trees along the western edge of mixed species AWI forest and would increase the prominence of road infrastructure in the landscape.	**Magnitude:** Minor **Significance:** Slight
Option ST2B	**ch8280 to ch8420** ▪ As Option ST2A	**Magnitude:** Minor **Significance:** Slight
Option ST2C	**ch8280 to ch8420** ▪ As Option ST2A	**Magnitude:** Minor **Significance:** Slight
Option ST2D	**ch8280 to ch8420** ▪ As Option ST2A	**Magnitude:** Minor **Significance:** Slight

Table 12.9: Potential Impacts and Effects on National Landscape and other Relevant Designations (with 'embedded' mitigation)

Route Option	River Tay (Dunkeld) NSA	Murthly Castle GDL	The Hermitage GDL	Dunkeld House GDL
	Sensitivity: High	**Sensitivity:** High	**Sensitivity:** High	**Sensitivity:** High
Option ST2A	The proposed route option would result in the increased prominence of road infrastructure, structures and earthworks within the NSA which would result in direct and indirect impacts to the features which contribute to the SQ's of the NSA. Impact on SQ2, 'Gateway to the Highlands' with the implementation of the grade separated Murthly Junction at Dalpowie Plantation and the tunnelled section at Birnam/Little Dunkeld. The predicted potential effects on the SQ's of the NSA are as follows: 1. The Beauty of Cultural Landscapes Accompanying Natural Grandeur: Slight. 2. The 'Gateway to the Highlands': **Large.** 3. Characterful Rivers, Waterfalls and Kettle-hole lochs: Slight. 4. Exceptionally Rich, Varied and Beautiful Woodlands: Slight. 5. The Picturesque Cathedral Town of Dunkeld: Slight. 6. Drama of the Falls of Braan and the Hermitage: Slight. 7. Dunkeld House Policies: Slight. 8. Significant Specimen Trees: **Moderate.** 9. The Iconic View from King's Seat: Slight. A detailed assessment of the predicted impacts and effects resulting from the proposed route option on the NSA is provided in Appendix A12.1: *Assessment of Predicted Potential Impacts and Effects on the Special Qualities of the River Tay (Dunkeld) National Scenic Area.*	Proposed junction including overbridge (ch800) and associated slip roads and earthworks would result in the increased prominence of road infrastructure and earthworks within the GDL at this location. The introduction of the proposed SuDS feature and associated earthworks would result in the loss of an area of existing woodland and alter the landform adjacent to the southbound merge (ch500). Elsewhere, the widening of the A9, proposed SuDS feature and associated earthworks this proposed route option would have the potential for little effect on the key features or scenic value of the GDL. **Predicted Magnitude of Impact:** Minor **Predicted Effect:** Slight	Earthworks associated with the left-in / left-out in at ch5250 would encroach on and result in the partial loss of the Old Military Road, Walkers, cyclists and horse-riders (WCH) paths (Core Paths and a Right of Way) and a small area of mature woodland within the GDL. However, this would have little effect on the key features or scenic value of the GDL. **Predicted Magnitude of Impact:** Minor **Predicted Effect:** Slight	No direct impacts on landscape elements and features within the GDL. Minor indirect impacts on the wider setting of the GDL would occur as a result of the increased visibility and influence of the widened A9. **Predicted Magnitude of Impact:** Minor **Predicted Effect:** Slight

Route Option	River Tay (Dunkeld) NSA	Murthly Castle GDL	The Hermitage GDL	Dunkeld House GDL
	Sensitivity: High	**Sensitivity:** High	**Sensitivity:** High	**Sensitivity:** High
Option ST2B	The proposed route option would result in the increased prominence of road infrastructure, structures and earthworks within the NSA which would result in direct and indirect impacts on the features which contribute to the SQ's of the NSA. Impact on SQ2, 'Gateway to the Highlands' with the implementation of the large-scale retaining structures and underpass as the route passes to the south of Little Dunkeld and Birnam. A detailed assessment of the predicted impacts and effects resulting from the proposed route option on the NSA is provided in *Appendix A12.1: Assessment of Predicted Potential Impacts and Effects on the Special Qualities of the River Tay (Dunkeld) National Scenic Area.* The predicted potential effects on the SQ's of the NSA are as follows: 1. The Beauty of Cultural Landscapes Accompanying Natural Grandeur: **Moderate.** 2. The 'Gateway to the Highlands': **Moderate.** 3. Characterful Rivers, Waterfalls and Kettle-hole Lochs: Slight. 4. Exceptionally Rich, Varied and Beautiful Woodlands: Slight. 5. The Picturesque Cathedral Town of Dunkeld: Slight. 6. Drama of the Falls of Braan and the Hermitage: Slight. 7. Dunkeld House Policies: Slight. 8. Significant specimen trees: **Moderate.** 9. The Iconic View from King's Seat: Slight.	Proposed widening of A9, junction arrangement south of Birnam and new SuDS feature with associated earthworks affecting landform and woodland would have little effect on the key features or scenic value of the GDL. **Predicted Magnitude of Impact:** Minor **Predicted Effect:** Slight	As Option ST2A.	As Option ST2A.

Route Option	River Tay (Dunkeld) NSA	Murthly Castle GDL	The Hermitage GDL	Dunkeld House GDL
	Sensitivity: High	**Sensitivity:** High	**Sensitivity:** High	**Sensitivity:** High
Option ST2C	The proposed route option would result in the increased prominence of road infrastructure, structures and earthworks within the NSA which would result in direct and indirect changes to the features which contribute to the SQ's of the NSA. Impacts resulting from the 9.5m increase in vertical alignment, the grade separated junction at Little Dunkeld the large-scale retaining structure at approx. ch4200 and the proposed crossing of the River Braan. A detailed assessment of the predicted impacts and effects resulting from the proposed route option on the NSA is provided in *Appendix A12.1: Assessment of Predicted Potential Impacts and Effects on the Special Qualities of the River Tay (Dunkeld) National Scenic Area.* The predicted potential effects on the SQ's of the NSA are as follows: 1. The Beauty of Cultural Landscapes Accompanying Natural Grandeur: **Moderate.** 2. The 'Gateway to the Highlands': **Moderate.** 3. Characterful Rivers, Waterfalls and Kettle-hole Lochs: **Moderate**. 4. Exceptionally Rich, Varied and Beautiful Woodlands: Slight. 5. The Picturesque Cathedral Town of Dunkeld: **Moderate.** 6. Drama of the Falls of Braan and the Hermitage: Slight. 7. Dunkeld House Policies: **Moderate.** 8. Significant Specimen Trees: **Moderate.** 9. The Iconic View from King's Seat: Slight.	As Option ST2B.	As Option ST2A.	No direct effects on landscape elements and features within the GDL. Minor indirect impacts on the wider setting of the GDL would occur as a result of the increased visibility and influence of the widened A9, including views of the large-scale retaining wall opposite the cathedral. **Predicted Magnitude of Impact:** Minor **Predicted Effect:** Slight
Option ST2D	The proposed route option would result in the increased prominence of road infrastructure, structures and earthworks within the NSA which would result in direct and indirect effects on the features which contribute to the SQ's of the NSA A detailed assessment of the predicted impacts and effects resulting from the proposed route option on the NSA is provided in *Appendix A12.1: Assessment of Predicted Potential Impacts and Effects on the Special Qualities of the River Tay (Dunkeld) National Scenic Area.*	As Option ST2B.	As Option ST2A.	As Option ST2A.

Route Option	River Tay (Dunkeld) NSA	Murthly Castle GDL	The Hermitage GDL	Dunkeld House GDL
	Sensitivity: High	**Sensitivity:** High	**Sensitivity:** High	**Sensitivity:** High
	The predicted potential effects on the SQ's of the NSA are as follows: 1. The Beauty of Cultural Landscapes Accompanying Natural Grandeur: Slight/Moderate. 2. The 'Gateway to the Highlands': Slight/Moderate. 3. Characterful Rivers, Waterfalls and Kettle-hole Lochs: Slight. 4. Exceptionally Rich, Varied and Beautiful Woodlands: Slight. 5. The Picturesque Cathedral Town of Dunkeld: Slight. 6. Drama of the Falls of Braan and the Hermitage: Slight. 7. Dunkeld House Policies: Slight. 8. Significant Specimen Trees: **Moderate.** 9. The Iconic View from King's Seat: Slight.			

Table 12.10: Potential Impacts and Effects on Local Landscape and other Relevant Designations (with 'embedded' mitigation)

Route Option	Dunkeld Conservation Area	Birnam Conservation Area
	Sensitivity: High	**Sensitivity: High**
Option ST2A	No direct impact or effect on the key features of the Conservation Area. Potential for minor change to views from the southern edge of the Conservation Area, as the road is embanked between Inver and Little Dunkeld and due to partial loss of intervening vegetation at and to the west of Little Dunkeld. As a result of the increase in visibility there would be a slight increase in the perceived impacts on the setting of the Conservation Area. **Predicted Magnitude of Impact:** Negligible **Predicted Effect:** Slight	Replacement station car park (accessed via Station Road) and linkage on top of the covered A9 where it passes Dunkeld & Birnam Station would improve the integrity of the two sections of Birnam Conservation Area either side of the A9. The creation of a new link between the two parts of the settlement and station would be beneficial for the Conservation Area. **Predicted Magnitude of Impact:** Minor **Predicted Effect:** Slight Beneficial

Route Option	Dunkeld Conservation Area	Birnam Conservation Area
	Sensitivity: High	**Sensitivity: High**
Option ST2B	As Option ST2A. **Predicted Magnitude of Impact:** Negligible **Predicted Effect:** Slight	Replacement station car park (accessed via Station Road) on top of proposed underpass would improve the integrity of the two sections of Birnam Conservation Area either side of the A9. The creation of a new link between the two parts of the settlement and station would be beneficial for the Conservation Area, although the significant retaining walls that would be visible to both sides of the new link would create a more urban appearance to the road, with the road continuing to have an impact on the setting of the Conservation Area. **Predicted Magnitude of Impact:** Minor **Predicted Effect:** Slight
Option ST2C	No direct change to the key features. Potential for changes to views from the southern edge of the Conservation Area, as the road is on high embankment between Inver and Little Dunkeld, in addition to the large retaining wall and partial loss of intervening vegetation at and to the west of Little Dunkeld. As a result of the increase in visibility there would be a slight increase in the perceived impacts on the setting of the Conversation Area. **Predicted Magnitude of Impact:** Minor/Moderate **Predicted Effect:** Slight	The proposed widening of the A9 and associated earthworks (the road is on a slight embankment between ch3000 and ch3200) would result in the loss of a narrow strip of woodland and roadside vegetation on either side of the mainline between approximately ch3000 and ch3500. Proposed SuDS feature at ch3500 would also result in the loss of an area of existing woodland within the Conservation Area. The removal of the vegetation would result in a slightly increased influence of road infrastructure on the qualities and the setting of the Conservation Area. **Predicted Magnitude of Impact:** Minor **Predicted Effect**: Slight
Option ST2D	As Option ST2A. **Predicted Magnitude of Impact:** Negligible **Predicted Effect**: Slight	As Option ST2C, with the exception that the proposed SuDS feature associated with this proposed route option would be located at ch3250. Also, low impacts associated with the new parking facility within the extent of Birnam Industrial Estate at the top of Station Road. **Predicted Magnitude of Impact:** Minor **Predicted Effect:** Slight

Impacts Common to All Proposed Route Options

12.4.7 The following section covers both impacts of stretches of the route common to all proposed route options and more general potential impacts that would occur along the entire route.

12.4.8 Between the start of the proposed route options (ch0) and Dalpowie Plantation (ch400), within the Lowland River Corridor: Strath Tay LLCA, and between Inver (ch4800) and the end of the proposed route options (ch8420), within the Strath Tay: Lower Glen and the Strath Tay: Mid Glen LLCAs, the proposed route options are broadly similar, with only minor variations in earthworks. This would not result in notable differences in potential impacts between the proposed route options, with the potential impacts arising, in general, from:

- the additional carriageway and realignment of the road;
- the new junction at Dalguise;
- loss of woodland including areas in the AWI (areas within Murthly Castle GDL, the Birnam/Dunkeld LCA (subsidiary) and River Tay (Dunkeld) NSA);
- introduction of larger bridge structures over watercourses (e.g. the widened crossing over the River Braan);
- alteration of vegetation patterns and field patterns as a result of tree loss and stripping of groundcover vegetation and topsoil, followed by reinstatement and new planting;
- exposure of new larger scale cuttings;
- new sections of embankment and local access routes with associated earthworks; and
- proposed new SuDS features.

12.4.9 The following potential impacts are predicted for all proposed route options:

- Physical impacts to landscape designations, character and elements through the loss of existing features or the introduction of new features are predicted for all proposed route options.

12.4.10 From Inver (approx. ch4800) to ch6000, widening and associated earthworks and introduction of two new SuDS features (between ch4800 and ch4900 and between ch5800 and ch5950) would result in the loss of mature roadside and riparian trees including AWI/NWSS woodland and agricultural land.

12.4.11 From ch6000 to Inver Wood (ch6800), offline realignment to the northbound side, with cuttings into the wooded hillside, would alter the character of the road corridor landscape, with loss of mature dense conifer woodland (potentially increasing risk of windthrow in remaining areas) and introduction of large areas of rock cutting.

12.4.12 North of ch6800, the new Dalguise Junction and realigned B898 with extensive cuttings along the northbound side would result in the loss of large areas of mature, dense coniferous AWI/NWSS woodland and an existing agricultural field, with the road infrastructure becoming more prominent in this area. An area of open field to the southbound side of the mainline at ch7100 would be lost due to a proposed new SuDS feature.

12.4.13 North of the Dalguise Junction the new/extended railway structure would potentially be more visually prominent in the landscape than the existing structure due to the more skewed angle at which the route would cross it.

12.4.14 Widening from ch7200 to the end of the proposed route options on the southbound side, including the widened River Tay bridge crossing, would result in loss of some roadside and mature NWSS riparian woodland. North of the River Tay crossing, extensive cuttings on the southbound side would result in the loss of an area of low-lying scrub and mature trees along the western edge of mixed species AWI forest. Introduction of a proposed new SuDS feature would result in the loss of an area of existing broadleaved woodland adjacent to the northbound carriageway at ch7900.

12.4.15 Taking into account the predicted impacts associated with all proposed route options, the overall potential effect on the landscape within the Lowland River Corridor: Strath Tay LLCA is predicted to be of Slight significance for all proposed route options from ch0-ch400, Moderate significance for all proposed route options within the Strath Tay: Lower Glen LLCA between approximately ch4800 and ch8280 and Slight significance for all proposed route options within the Strath Tay: Mid Glen LLCA between approximately ch8280 and the end of the proposed route options (ch8420).

Impacts Specific to Option ST2A

12.4.16 The following section summarises the potential impacts identified in Tables 12.7, 12.8 and 12.9 that are specific to Option ST2A or are common to Option ST2A and at least one of the other options, but not all. The construction period for Option ST2A is estimated as being 4.5 to 5 years, during which there would be potential for localised temporary impacts on landscape character.

Lowland River Corridor: Strath Tay LLCA, Strath Tay: Lower Glen LLCA and Strath Tay: Dunkeld and Birnam LLCA (Settlement) (approx. ch400 to ch4800)

12.4.17 Within the section of the route from ch400 to the proposed tunnel entrance at ch2150, including the grade separated Murthly Junction and new access to Murthly Castle at Dalpowie (approx. ch800), potential impacts on the Lowland River Corridor: Strath Tay LLCA, Strath Tay: Lower Glen LLCAs and the Murthly GDL would arise from the loss of woodland, large-scale earthworks and new structures. As a result, road infrastructure would become a more prominent element within the landscape and alter its character, however the impacts would be relatively localised.

12.4.18 An illustrative view of the proposed Murthly Junction is provided in Illustration 12.1.

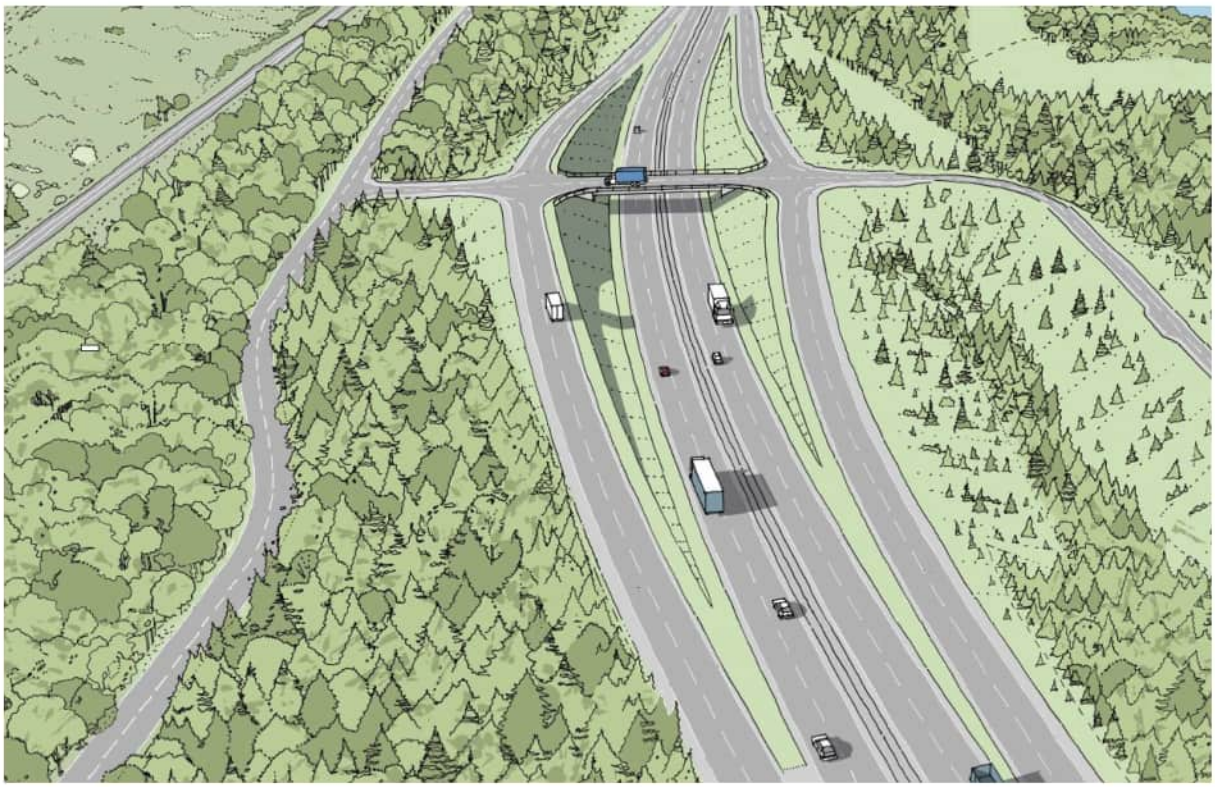

Illustration 12.1: Illustrative view of the proposed Murthly Junction (Note that mitigation planting is indicative only and would be subject to further development)

12.4.19 Between ch2150 and ch3800, the dualled A9 would be routed through a section of cut and cover tunnel. This would reduce the prominence of road infrastructure within the Strath Tay: Lower Glen LLCA and the Strath Tay: Dunkeld and Birnam LLCA (Settlement), resulting in a potential beneficial impact, albeit that the existing A9 is a well-established, and characteristic part of the Strath Tay: Lower Glen LLCA as it passes through the narrow glen. It would also facilitate a stronger linkage between north and south Birnam with the creation of the replacement station parking facility and the extension of Station Road. This stronger linkage is predicted to be beneficial to the Birnam CA. The tunnel would, however, have the potential to adversely affect the way in which NSA SQ2 'Gateway to the Highlands' is experienced by travellers on the A9.

12.4.20 Although there would potentially be limitations on the tree and shrub species which could be established on top of the tunnel, the removal of the road and introduction of vegetation would potentially provide some benefits when operational, increasing as the planting on the tunnel establishes and matures.

12.4.21 Between the north cut and cover tunnel portal (ch3700) and ch4100, potential impacts would result from the portal structure which would require loss of roadside woodland due to extended cuttings.

12.4.22 Between ch4000 and ch4800, potential impacts on the landscape would occur as a result of the at-grade roundabout and the widened crossing of the River Braan, with associated changes to the landform and the loss of woodland. These potential impacts would be common to Options ST2B and ST2D. An illustrative view of the northern tunnel portal and the roundabout (which is common to Options ST2B and ST2D) is provided in Illustration 12.2.

Illustration 12.2: Illustrative view of the five-spur roundabout at Little Dunkeld (Note that mitigation planting shown in the illustration is indicative only and would be subject to further development)

Impacts Specific to Option ST2B

12.4.23 The following section summarises the potential impacts identified in Tables 12.7, 12.8 and 12.9 that are specific to Option ST2B or are common to Option ST2B and at least one of the other proposed route options, but not all. The construction period for Option ST2B is estimated as being 4 to 4.5 years, during which there would be potential for localised temporary effects on landscape character.

Lowland River Corridor: Strath Tay LLCA, Strath Tay: Lower Glen LLCA and Strath Tay: Dunkeld and Birnam LLCA (Settlement) (approx. ch400 to ch4800)

12.4.24 Within the section of the route from ch400 to the proposed underpass at ch3150, potential impacts would arise from the loss of woodland, large-scale earthworks and new structures. As a result, road infrastructure would become a more prominent element within the landscape and alter its character, however the potential effects would be relatively localised.

12.4.25 Within this section of the route, the Birnam restricted movement junction would result in road infrastructure becoming more prominent in the landscape. As a consequence, potential impacts would arise as a result of the road widening, loss of woodland, and changes to the landform. These potential impacts would be common to Option ST2C and Option ST2D between ch400 and ch2500.

12.4.26 An illustrative view of the proposed junction is provided in Illustration 12.3.

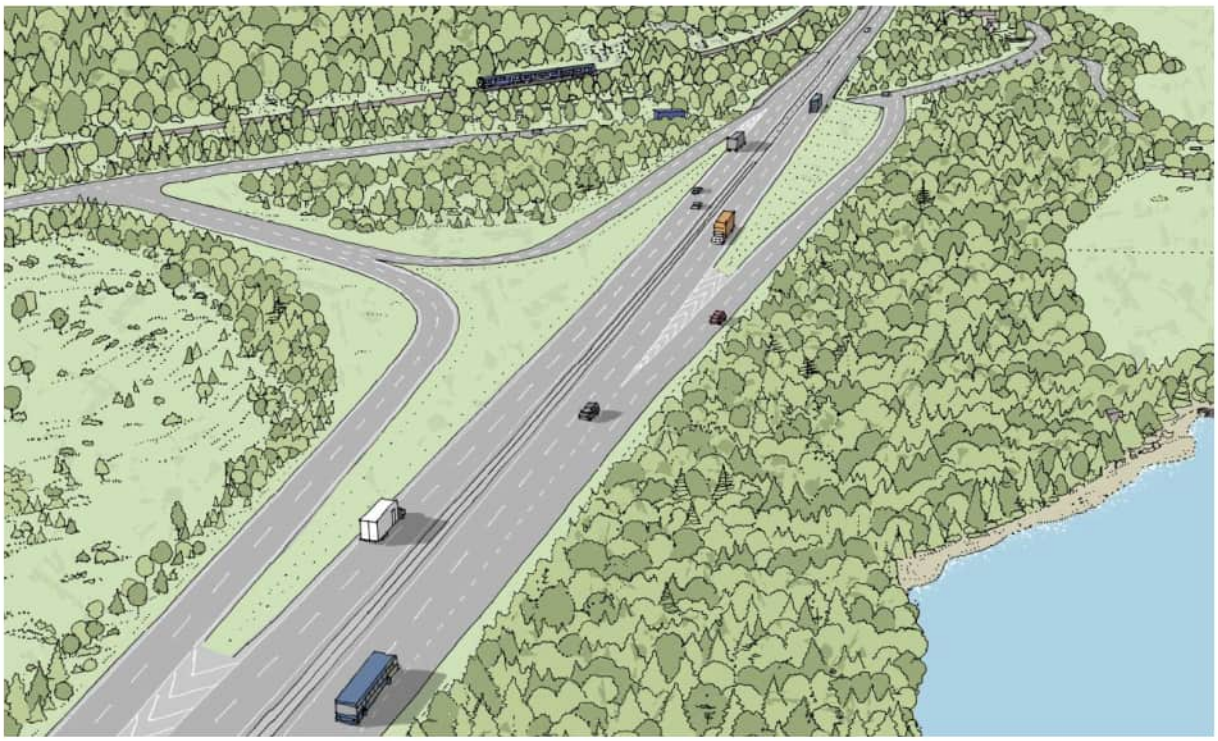

Illustration 12.3: Illustrative view of the proposed three arm junction at Birnam (Note that mitigation planting is indicative only and would be subject to further development)

12.4.27 Within the section of the route between ch2500 and ch4800, including the Dunkeld Junction and the River Braan crossing, road infrastructure would become considerably more prominent in the landscape as a result of widening and the loss of existing mature woodland.

12.4.28 Potential impacts would arise as a result of changes to vertical alignment, and large-scale earthworks and new structures, including large-scale retaining walls and the underpass on top of which the replacement Dunkeld & Birnam Station car park would be sited. However, visibility of the route from the wider landscape and opportunities to perceive changes in the landscape would be limited by retained existing woodland, topography and the new retaining structures in the vicinity of the proposed route option. From elevated positions in the wider landscape, the changes would be more perceptible. These potential impacts would be specific to Option ST2B.

12.4.29 At Dunkeld & Birnam Station, the proposed underpass would allow the widened road to pass approximately 8m below existing grade and the station car park on top of it would help to reconnect the village with the Dunkeld & Birnam Station and the two areas of Birnam currently separated by the A9, though it would also have an urbanising influence. The creation of a new link between the two parts of Birnam and the railway station would represent a potential beneficial impact for the Birnam Conservation Area, although the influence of the A9 on the setting of the Conservation Area would remain, with the large retaining walls required for this proposed route option likely to create a much more urban appearance to the road corridor which would also affect the setting of the Conservation Area. The underpass would have potential to adversely affect the way in which NSA SQ2 'Gateway to the Highlands' is experienced by travellers on the A9. This potential impact would be specific to Option ST2B.

12.4.30 An illustrative view of the underpass is provided in Illustration 12.4.

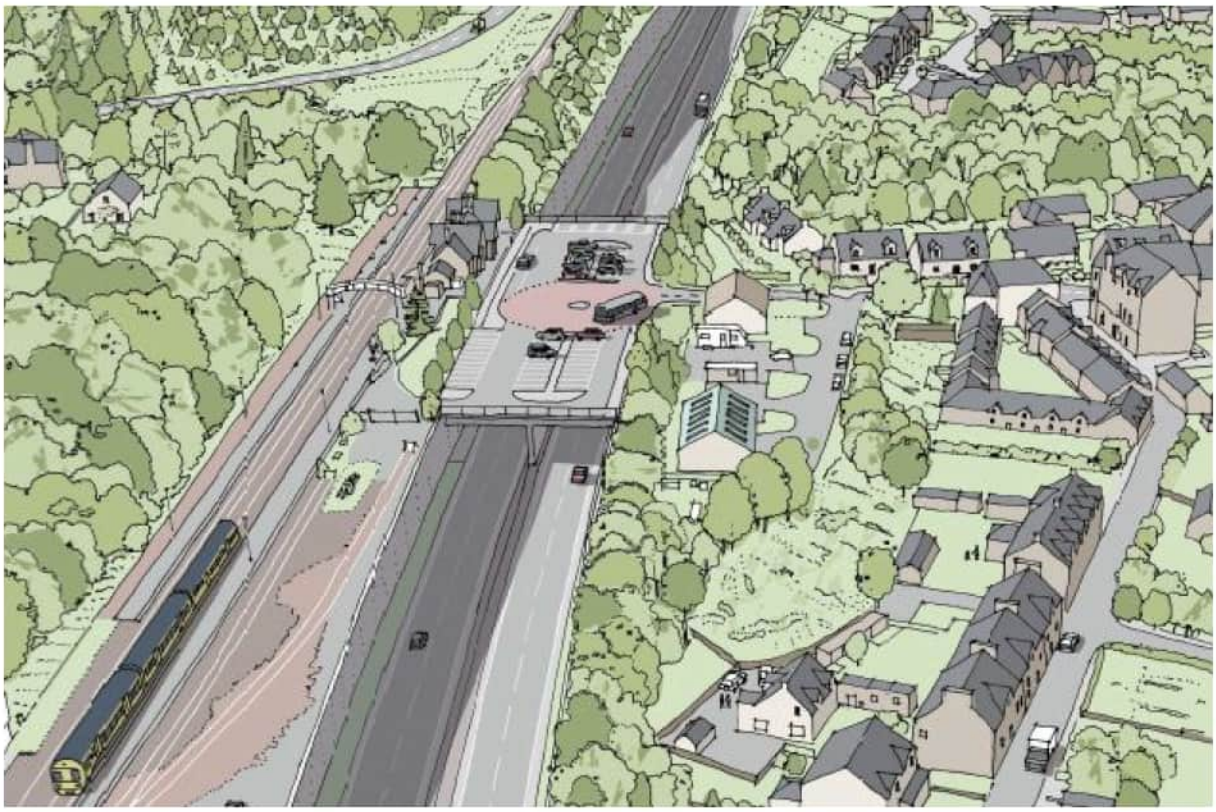

Illustration 12.4: Illustrative view of the proposed underpass at Dunkeld & Birnam Station (Note that mitigation planting is indicative only and would be subject to further development)

12.4.31 Between ch4000 and ch4800, potential impacts on the landscape would occur due to the at-grade roundabout and the widened crossing of the River Braan, with associated changes to the landform and the loss of woodland. These potential impacts would be common to Options ST2A and ST2D.

Impacts Specific to Option ST2C

12.4.32 The following section summarises the potential impacts identified in Tables 12.7, 12.8 and 12.9 that are specific to Option ST2C or are common to Option ST2C and at least one of the other proposed route options, but not all. The construction phase for Option ST2C is estimated as being 2.5 to 3 years, during which there would be potential for localised temporary effects on landscape character.

<u>Lowland River Corridor: Strath Tay LLCA, Strath Tay: Lower Glen LLCA and Strath Tay: Dunkeld and Birnam LLCA (Settlement) (approx. ch400 to ch4800)</u>

12.4.33 Between ch400 and Birnam Junction (ch1800) and from north of the junction to ch2700, potential landscape impacts would be common to Options ST2B and ST2D. Between ch2700 and ch3400, potential landscape impacts would be common to Option ST2D.

12.4.34 Within the section of the route from ch2700 to ch4800 road infrastructure would become considerably more prominent in the landscape as a result of widening, increased vertical alignment, side road realignment, large-scale earthworks and new structures.

12.4.35 Dunkeld Junction, including realigned side roads and associated cuttings and embankments, would result in the loss of existing woodland and roadside trees and open up the enclosed, wooded character of the existing A9 corridor and the road infrastructure, including the proposed underbridge and retaining walls, which would be prominent. The vertical alignment of the mainline would be raised where the A9 passes Little Dunkeld and there would be three separate lengths of lowheight retaining wall alongside the southbound merge slip road where it passes Telford Gardens and King Duncan's Place. The removal of the existing bund between the A9 and the Highland Main Line railway along the northbound diverge slip road to the Dunkeld Junction would further open up the enclosed, wooded character of the existing road corridor and extend the influence of the railway. In addition to impacting the LLCAs, the proposed Dunkeld Junction would be likely to impact the Dunkeld CA.

12.4.36 An illustrative view of the junction is provided in Illustration 12.5.

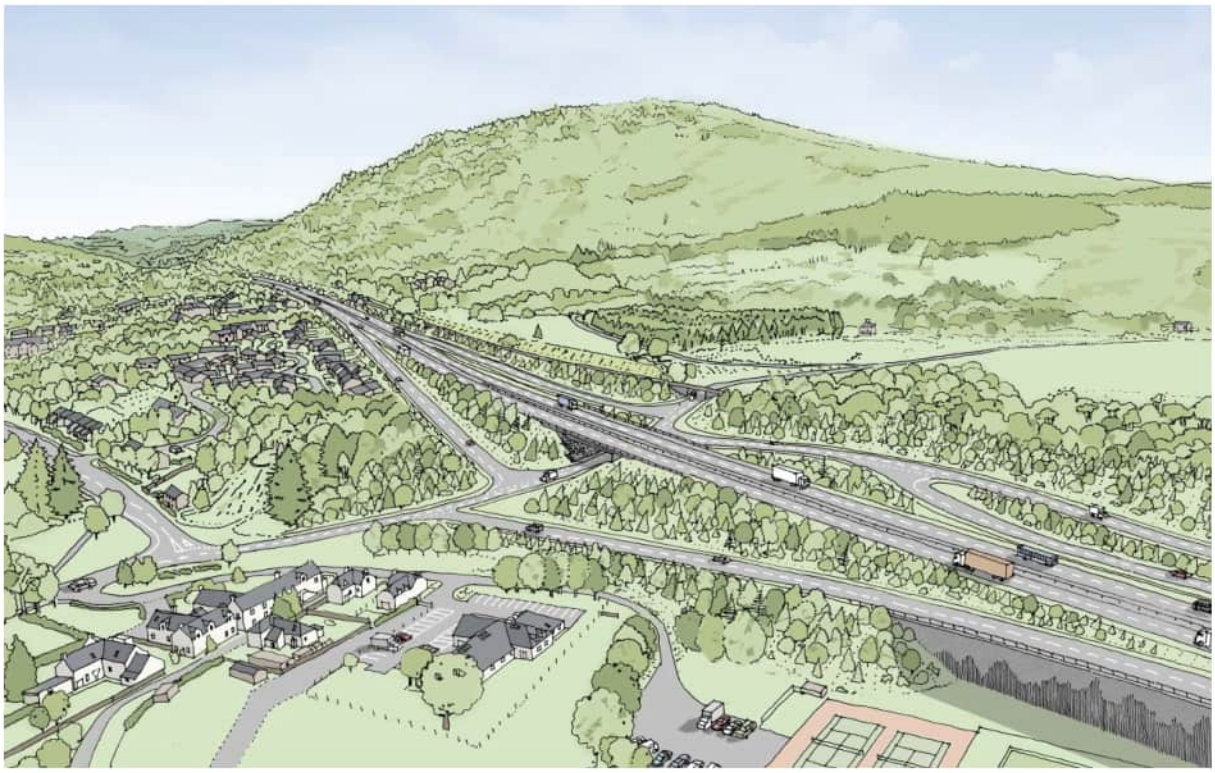

Illustration 12.5: Illustrative view of the proposed Dunkeld Junction (Note that mitigation planting is indicative only and would be subject to further development)

Impacts Specific to Option ST2D

12.4.37 The following section summarises the potential impacts identified in Tables 12.7, 12.8 and 12.9 that are specific to Option ST2D or are common to Option ST2D and at least one of the other proposed route options, but not all. The construction phase for Option ST2D is estimated as being 2.5 to 3 years, during which there would be potential for localised temporary effects on landscape character.

Between ch400 and Birnam Junction (ch1800) and from north of the junction to ch2700, potential landscape impacts would be common to Options ST2B and ST2C.

12.4.38 Between ch1800 and ch2700, the Birnam restricted movement junction would result in road infrastructure becoming more prominent in the landscape. As a consequence, potential impacts would arise as a result of the road widening, loss of woodland, loss of farmland and changes to the landform. These potential impacts would be common to Options ST2B and ST2C.

12.4.39 Within the section of the route from ch2700 to ch4000 road infrastructure would become more prominent in the landscape as a result of the widening and associated earthworks, in addition to the parking facility at the top of Station Road. However, the visual influence of the route on the wider landscape would be limited by retained existing woodland and topography.

12.4.40 An illustrative view of the proposed parking facility (which would be common to Option ST2C) is provided in Illustration 12.6.

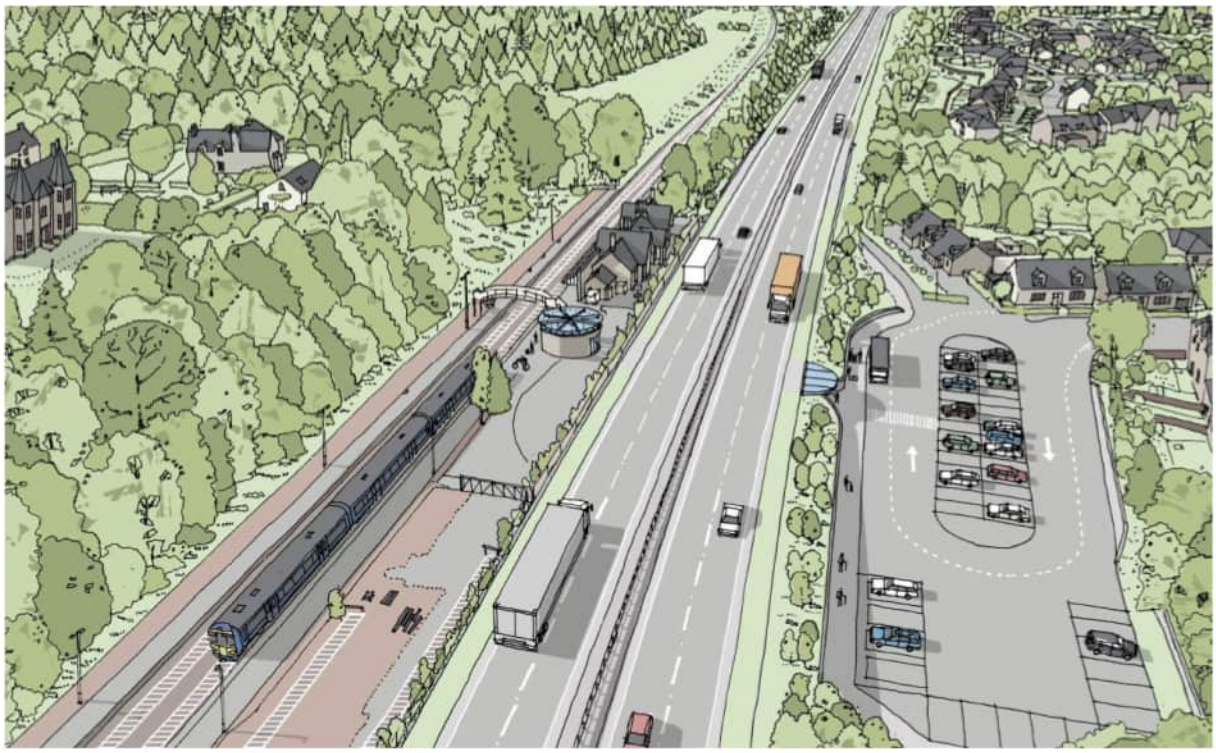

Illustration 12.6: Illustrative view of the proposed parking facility at the top of Station Road (Note that mitigation planting is indicative only and would be subject to further development)

12.4.41 Between ch4000 and ch4800, potential impacts on the landscape would occur due to the at-grade roundabout and the widened crossing of the River Braan, with associated changes to the landform and the loss of woodland. These potential impacts would be common to Options ST2A and ST2B.

12.5 Potential Mitigation

12.5.1 Anticipated potential mitigation measures for both construction and operational phases are described below.

Construction

12.5.2 During the construction phase, landscape and visual mitigation for the proposed route options would potentially include:

- Protection of vegetation and avoidance of damage to private ground.
- Sensitive siting of site compounds, plant and material storage areas to minimise their landscape impact. Where possible, site compounds should be located where existing features such as trees can be used to screen them from visual receptors. Where this is not possible, screening can be achieved using bunds or embankments which become part of the permanent works. Alternatively, temporary screens can be erected, designed and painted to be inconspicuous in their surroundings.

- Programming of works to reduce disruption, including keeping the construction programme to the minimum practicable time.
- Efficient traffic management and diversions for WCH on side roads.
- Avoidance of night-time working where feasible. Where necessary, directed lighting used to minimise light pollution/glare.
- Careful selection of plant and machinery.
- Construction sites to be kept tidy (e.g. free of litter and debris).

Operation

12.5.3 General opportunities for potential landscape mitigation measures, which would be subject to further assessment and design, are outlined below.

- Development of a design strategy in regard to the mitigation of impacts on the landscape elements which contribute to the SQ's of the River Tay (Dunkeld) NSA. This would include consideration of the 'Gateway to the Highlands' experience (Special Quality 2 (SQ2)) as experienced by road users in addition to tree planting proposals and potential landscape mitigation measures in consideration of 'the beauty of cultural landscapes accompanying natural grandeur' and 'exceptionally rich, varied and beautiful woodlands' SQ's (SQ1 and SQ4).
- Retention of existing trees and vegetation wherever possible and incorporation with new planting proposals to provide screening of views for receptors, to reinforce the character of the existing landscape, reinstate/enhance the SQ's of the NSA and to enhance the experience of travelling along the road.
- Enhancement of biodiversity through use of native species which are adapted to local conditions.
- Planting to replace trees lost during the construction. Where possible, advanced planting is desirable in those areas where planting could be completed ahead of the general completion of the proposed scheme. Following the completion of construction, areas that had been used for temporary features such as the site compounds (including mud and concreate batching plants associated with Option ST2A) would be appropriately restored or re-instated to their former land use.
- Use of retaining walls or engineered slopes where appropriate to avoid extensive cuttings into hill slopes or large embankments that 'chase the slope' and increase the disturbance of the landscape. Where rock cuttings are required, create rock formations that have a naturalistic appearance that can become features of the landscape.
- Sensitive design of retaining walls. All proposed route options would require significant areas of visually prominent retaining wall, so special attention to high quality design and finishes is considered essential.
- Sensitive design of structures to integrate with the surrounding landscape; design of bridges/underpasses to minimise the degree of severance between the landscape areas either side of the widened A9.
- Use opportunities for new structures and roundabouts as gateways to enhance sense of arrival/linkages or provide landmark features.
- Irregular edge/shaping of SuDS basins to improve their integration with the surrounding landform.

12.5.4 Potential mitigation for woodland habitat loss in terms of ecological impacts is discussed in Volume 1, Part 3 – Environmental Assessment (Chapter 11: Biodiversity).

12.5.5 Conceptual indicative landscape mitigation proposals for each of the proposed route options are illustrated on Figures 12.4 to 12.7. These have proposals been tailored to each of the proposed route options to take account of the potential impact assessments reported in Section 12.5 (Potential Mitigation) and in Section 13.5 (Potential Mitigation) of Volume 1, Part 3 – Environmental Assessment (Chapter 13: Visual), along with the SQ's of the River Tay (Dunkeld) NSA and the woodlands within the Murthly Castle GDL. The proposed route option specific measures include:

- Sensitive design of mitigation proposals in order to integrate Murthly Junction into the landscape including potential consideration of non-native tree species similar to reflect those found within Murthly Castle GDL (Option ST2A).
- Sensitive design of the mitigation proposals in order to integrate Birnam Junction into the landscape including potential consideration of non-native tree species to reflect those found within Murthly Castle GDL (Options ST2B, ST2C and ST2D).
- Design of tunnel portals to enhance the views experienced by road users with potential to introduce a landmark feature particularly for northbound travellers in relation to the 'Gateway to the Highlands' experience (Option ST2A).
- Landscape design of the top of the cut and cover tunnel adopting a combination of 'meadow' areas/scrub planting in addition to woodland planting (where soil depths allow). The design would also include mounding/landforming in order to help integrate the cover into the landscape (Option ST2A).
- Replacement arrival courtyard/car parking facility for the Dunkeld & Birnam Station above the tunnel (ST2A) and underpass (ST2B) at Birnam Glen would create a stronger sense of arrival on the approach to the Dunkeld & Birnam Station and would re-connect the two areas of Birnam either side of the A9 (Options ST2A and ST2B).
- Potential for formal planting at replacement car parking facility at the top of Station Road to create a stronger sense of arrival on the approach to the Dunkeld & Birnam Station (Options ST2C and ST2D).

12.5.6 Due to concerns regarding potential root damage to the tunnel structure it is anticipated that planting on top of the cut and cover tunnel associated with Option ST2A would comprise shallow rooting scrub species and meadow/grassland. It is suggested that if a satisfactory root barrier were to be installed then larger tree species reflecting the surrounding woodlands would be able to be planted.

12.5.7 The indicative conceptual landscape mitigation proposals are preliminary at this stage and would be developed further as part of the assessment of the Preferred Route Option and its detailed design and assessment. Other opportunities not listed above may arise as the design is developed in greater detail and during the course of the detailed assessment of the Preferred Route Option and stakeholder consultation.

12.6 Summary of Route Options Assessment

12.6.1 This section provides a summary of the route options assessment of potential impacts and effects for the four proposed route options with 'embedded' mitigation measures incorporated in the designs of the proposed route options (e.g. alignment, design elements, grading out of earthworks) and the potential mitigation measures described in Section 12.5 (Potential Mitigation). Professional judgement has been used to consider the likely mitigating effects of more detailed landscape mitigation (allowing for fifteen years of growth, i.e. a 'summer 15 years after opening' scenario), which would be developed as part of DMRB Stage 3 for the Preferred Route Option and would include measures such as replacement woodland planting to screen views and improve landscape integration. As the level of detail provided in the landscape mitigation proposals on Figures 12.4 to 12.7 is indicative only, the residual effects in this summary section are necessarily precautionary (i.e. it may be possible to further reduce stated effects as part of the detailed design and assessment of the Preferred Route Option).

12.6.2 For the comparison of proposed route options, two aspects are considered; whether the potential for any residual effects would be considered significant in the context of the EIA Regulations, and whether any of the potential impacts and effects identified differ sufficiently between route options such that they can be considered a differentiator and need to be considered as part of the overall identification of the Preferred Route Option which, as explained in Volume 1, Part 3 – Environmental Assessment (Chapter 7: Overview of Environmental Assessment), takes into account environmental, engineering, economic and traffic considerations.

12.6.3 The landscape assessment has identified a number of potential effects associated with the proposed route options, as shown in Tables 12.8 to 12.10. Potentially significant effects on the landscape resource, in the context of the EIA Regulations, are associated with all proposed route options for the section of route within the Strath Tay: Lower Glen LLCA and Strath Tay: Dunkeld and Birnam LLCA (Settlement) and the River Tay (Dunkeld) NSA between Dalpowie Plantation (ch900) and ch8280, north of the River Tay crossing.

12.6.4 The four proposed route options are identical from Inver (approx. ch4800) to the end of the scheme, and it is the preceding section of the scheme, particularly at Murthly and between Birnam and Little Dunkeld where the differences between them are most pronounced; Option ST2A including a 1.5km long tunnelled section, Option ST2B including a dualled section 8m below the existing grade which is partially covered, Option ST2C including a raised/embanked section where it passes Little Dunkeld, and Option ST2D being retained at-grade in addition to incorporating a new parking facility within the extent of Birnam Industrial Estate to the south of Station Road.

12.6.5 In comparison to the other proposed route options, Option ST2D is the most similar to the existing situation, with lesser potential effects on the landscape resource during the construction and operational phases than Option ST2B and Option ST2C. As a result of the cut and cover tunnel section, Option ST2A would potentially result in a localised reduction of the influence of road infrastructure on the character of the landscape.

12.6.6 All of the proposed route options would result in the loss of woodland, including AWI broadleaved woodland, roadside screening trees and small areas of agricultural land to some degree. These changes to landscape features which contribute to the character of the landscape would be as a direct result of the proposed widening of the carriageway, the new junction options and associated earthworks.

12.6.7 With the implementation of the indicative conceptual landscape mitigation proposals, it is predicted that the effects on landscape receptors would be likely to be reduced in most instances. These reductions would primarily result from the establishment of planting along the length of the proposed route options. In particular, the landscape mitigation proposals would help to integrate the widened A9 and the junction proposals into the landscape while a more formal approach to the planting proposals could be adopted at specific locations in order to create landmark features such as the Little Dunkeld roundabout (Options ST2A, ST2B and ST2D), the Dalguise Junction (all proposed route options) or at the tunnel portals associated with Option ST2A.

12.6.8 A summary assessment is provided in Table 12.11, this assessment takes into account 'embedded' mitigation measures incorporated into the designs of the proposed route options (e.g. alignment, design elements, grading out of earthworks) and the potential mitigation measures described in Section 12.5 (Potential Mitigation).

12.6.9 The differences in potential effects between proposed route options are considered sufficient to differentiate between them and a comparative assessment is provided in Table 12.11: Summary of Assessment – Landscape.

Table 12.11: Summary of Assessment - Landscape

Chapter/Subcategory			Predicted Residual Effect				Comments
			Option ST2A	Option ST2B	Option ST2C	Option ST2D	
Landscape	Construction	All subcategories					Effects resulting from construction would be broadly similar for all proposed route options, despite the differences in the duration of the impacts, and effects would be largely reversible, so are not considered sufficient to be a differentiator.
	Operation	Strath Tay: Lower Glen LLCA	Slight	Slight	Slight	Slight	Option ST2A would have slightly greater effects on the LLCA than Option ST2B, Option ST2C and Option ST2D due to the grade separated Murthly Junction resulting in greater woodland loss and changes to landform (the junction associated with these options being located in the neighbouring Strath Tay: Lower Glen LLCA). While there is a minor difference in the level of effect between Option ST2A and the other three proposed route options on the Strath Tay: Lower Glen LLCA this difference in effect is not considered sufficient to be a differentiator.
		Strath Tay: Lower Glen LLCA	**Moderate**	**Large**	**Large**	**Moderate**	Option ST2A with the cut and cover tunnel would ultimately have a slightly lesser effect on the landscape of the LLCA than Option ST2B and Option ST2C. Both of these proposed route options would increase the prominence of road infrastructure and affect the character of the landscape in comparison to Option ST2A and Option ST2D. Option ST2A would have a similar magnitude of effect to Option ST2D. Option ST2B would have a greater effect due to the underpass section, which would result in higher effects on the landscape character and lesser mitigation opportunities. Option ST2C would have a similar level of effect as Option ST2B (although different in design) and would also be more challenging to mitigate due to its raised alignment. In summary, the greater prominence of the road infrastructure in Option ST2B and Option ST2C means that the differences in effect between Option ST2A and Option ST2B, Option ST2A and Option ST2C, Option ST2B and Option ST2D and between Options ST2C and Option ST2D, are considered sufficient to be differentiators within the Strath Tay: Lower Glen LLCA. The differences in effect between Option ST2A and Option ST2D, and between Option ST2B and Option ST2C are not considered sufficient to be a differentiator.

Chapter/Subcategory			Predicted Residual Effect				Comments
			Option ST2A	Option ST2B	Option ST2C	Option ST2D	
Landscape	Operation	Strath Tay: Dunkeld and Birnam LLCA (Settlement)	Slight	Slight	**Moderate**	Slight	Option ST2C would have greater effects on the LLCA than Option ST2A, Option ST2B and Option ST2D due to the greater prominence of road infrastructure associated with the proposed grade separated Dunkeld Junction. Option ST2B would have a slightly greater effect than Option ST2A and Option ST2D due to the proposed underpass section which would result in the loss of areas of mature roadside woodland and alterations to the existing landform along the southern edge of the settlement. The differences in effect are considered sufficient to be a differentiator.
		Strath Tay: Mid Glen LLCA	Slight	Slight	Slight	Slight	Effects resulting from the proposed large-scale, cuttings on the southbound side from ch8280 to the end of the proposed route options (ch8420) would be the same for all proposed route options.
		River Tay (Dunkeld) NSA	No significant risk to the integrity of the designation	No significant risk to the integrity of the designation	No significant risk to the integrity of the designation	No significant risk to the integrity of the designation	All proposed route options would affect one or more of the SQ's of the NSA (refer *to Appendix A12.1: Assessment of Predicted Potential Impacts and Effects on the Special Qualities of the River Tay (Dunkeld) National Scenic Area*). Of particular relevance would be the predicted effects on the 'Gateway to the Highlands' SQ as experienced by users of the A9 (refer to Chapter 13: Visual and *Appendix A13.2: View from the Road*). This is due to the predicted changes to the traveller's experience of passage through Strath Tay with Option ST2A, Option ST2B, and Option ST2C predicted to affect the 'Gateway to the Highlands' experience more so than Option ST2D. Option ST2A is predicted to result in the greatest effect on this SQ. Option ST2C would affect 'the beauty of cultural landscapes accompanying natural grandeur' and 'exceptionally rich, varied and beautiful woodlands' SQs more so than Option ST2A, Option ST2B and Option ST2D due to Option ST2C's grade separated junction at Little Dunkeld and lesser opportunities for mitigation planting. Option ST2D would have the least overall effect on the SQs of the River Tay (Dunkeld) NSA. However, none of the proposed route options would pose a significant risk to the integrity of the NSA and the differences in effects on the designation are not considered sufficient to be a differentiator.
		Murthly Castle GDL	Slight	Slight	Slight	Slight	The proposed Murthly Junction associated with Option ST2A would have a greater effect on the designation than the junction arrangement at Birnam associated with Option ST2B, Option ST2C, and Option ST2D. While there is a minor difference in the level of effect between Option ST2A and the other three proposed route options on the Murthly Castle GDL this difference is not considered sufficient to be a differentiator.

Chapter/Subcategory			Predicted Residual Effect				Comments
			Option ST2A	Option ST2B	Option ST2C	Option ST2D	
Landscape	Operation	The Hermitage GDL	Slight	Slight	Slight	Slight	There are no differences in the level of effect on the Hermitage GDL between the proposed route options. As such, the effects on the designation are not considered sufficient to be a differentiator.
		Dunkeld House GDL	Neutral	Neutral	Slight	Neutral	There is a difference in the level of effect between Option ST2C and the other three proposed route options on the Dunkeld House GDL. This difference in effect is not however considered sufficient to be a differentiator.
		Dunkeld CA	Neutral	Neutral	Slight	Neutral	The elevated vertical alignment of Option ST2C would result in a greater level of indirect effect on the Dunkeld CA however there would be no direct effects on the CA as a result of the proposed route options. While there is a difference in effect between Option ST2C and the other three proposed route options on the Dunkeld CA the difference in effect is not considered sufficient to be a differentiator.
		Birnam CA	Slight Beneficial	Slight	Slight	Slight	The difference in effect between Option ST2A and each of the other three proposed route options on the Birnam CA (slight beneficial as opposed to slight adverse) is considered sufficient to be a differentiator.

Compliance Against Plans and Policies

12.6.10 DMRB LA 104 states that environmental assessment, reporting and monitoring shall meet the requirements of the national planning policy for each relevant Overseeing Organisation.

12.6.11 *Appendix A21.1 (Assessment of Policy Compliance)* provides a review of national, regional and local policy documents which are of relevance to this assessment undertaken and reported in this chapter in accordance with DMRB guidance.

12.6.12 National Planning Policy objectives (and accompanying best practice guidance) of relevance to this assessment are provided in National Planning Framework 3 (Scottish Government, 2014a), Scottish Planning Policy (SPP) (Scottish Government, 2014b; Revised 2020) themes *Valuing the Natural Environment*, *Placemaking*, *Valuing the Historic Environment* and *Maximising the Benefits of Green Infrastructure*, *National Transport Strategy 2 (NTS2) (Transport Scotland, 2020),* Scotland's Third Land Use Strategy 2021-2026 (Scottish Government, 2020), and Fitting Landscapes (Transport Scotland, 2014a). In addition, local policies of relevance include Perth and Kinross Local Development Plan 2 (PKC LDP2) (PKC, 2019) Policies 1 (Placemaking), 28 (Conservation Areas), 39 (Landscape), 40 (Forestry, Woodland and Trees) and 42 (Green Infrastructure). TAYplan (TAYplan, 2017) Policies 2 (Shaping Better Quality Places) and 9 (Managing TAYplan's Assets) are also of relevance.

12.6.13 A full policy compliance assessment can be found in Table 5 of *Appendix A21.1 (Assessment of Policy Compliance)* which combines the assessments of Chapters 12 (Landscape) and 13 (Visual) due to the similarity in policy of relevance. It is assessed that although significant effects are anticipated related to landscape quality and viewpoint locations, implementation of mitigation measures is anticipated to reduce impacts on receptors in most cases. Upon confirmation of specific mitigation proposals at DMRB Stage 3, full policy compliance assessment can be undertaken.

Community Objectives

12.6.14 The community objectives (refer to Volume 1, Part 3 – Environmental Assessment (Chapter 7: Overview of Environmental Assessment, Table 7.2)) have been considered throughout DMRB Stage 2. *Appendix A7.1: Mapping of Community Objectives Against DMRB Stage 2 Route Options* sets out which DMRB Stage 2 environmental topics are relevant to each of the objectives.

12.6.15 In *Appendix A7.1: Mapping of Community Objectives Against DMRB Stage 2 Route Options*, confirms that community objectives 2 and 5 are relevant to the assessment of Landscape. Professional judgement has been used to consider how the proposed route options contribute to these objectives for the operation phase, as summarised in Table 12.12.

12.6.16 The contribution of the operation phase of each of the proposed route options to the relevant community objectives was categorised according to the following key.

Contributes to all/most of the community objective

Contributes to part of the community objective

Contributes to little/none of the community objective

Table 12.12: Contribution to Community Objectives During Operation for this Environmental Topic

Relevant Community Objective		Option ST2A	Option ST2B	Option ST2C	Option ST2D
2	Protect and enhance the scenic beauty and natural heritage of the area and its distinctive character and quality.				
5	Examine and identify opportunities to enhance the levels of cycling and walking for transport and leisure, including the improvement of existing footpaths and cycle ways, to promote positive mental health and well-being.				

12.6.17 Option ST2A is considered to contribute in part to Objective 5, due to the potential for landscaping the covered tunnel with amenity space in addition to improvements to the footpath and cycle networks. However, there would be potential for adverse effects along other stretches of the route. All other proposed route options are not considered to contribute meaningfully to objectives 2 and 5 in terms of landscape. Potential effects during construction on the landscape would be broadly similar for all proposed route options and are not considered to contribute to the community objectives. However, mitigation measures would be developed and considered at DMRB Stage 3, with the aim to reduce the potentially significant effects of the proposed scheme and address as far as practicable the community's objectives. As indicated in Section 12.5 (Potential Mitigation) these include:

- During construction, the protection of vegetation in addition to the sensitive siting of site compounds.
- During operation, the development of a design strategy in order to minimise effects on the River Tay (Dunkeld) NSA and to reinforce the character of the existing landscape. The replacement of trees lost during construction.

Comparative Assessment

12.6.18 Consideration of the differences in potential effects associated with each of the proposed route options allows for a comparative assessment as provided in Table 12.13. This comparative assessment has taken into account the potential effect of each of the proposed route options on the landscape resource including the key aspects of the landscape designations through which the routes would pass, such as the SQ's of the River Tay (Dunkeld) NSA and potential effects on GDLs.

Table 12.13: Comparative Assessment - Landscape

Route Option	Lowest Overall Effect	Intermediate Overall Effect	Highest Overall Effect
Option ST2A	✓		
Option ST2B			✓
Option ST2C			✓
Option ST2D	✓		

12.6.19 In summary, the differences between proposed route options are considered sufficient to be differentiators, with Option ST2A and Option ST2D having the lowest overall effect and Option ST2B and Option ST2C the highest overall effect when considering potential effects on both landscape character and landscape designations. However, if the integrity of the cut and cover tunnel structure were to be safeguarded (for example through the use of a satisfactory root barrier), establishment of areas of woodland using large tree species above the tunnel (as opposed to grassland and shallow rooted scrub planting assumed in the assessment, to avoid the risk of root damage to the structure) would improve the fit with the character of the landscape. Adoption of such an approach to the planting above the tunnel would also potentially reduce effects on the SQ's of the NSA. In such a scenario, taking into consideration the potential benefit to landscape character, a 'wooded' cover to the tunnel would differentiate Option ST2A from Option ST2D, Option ST2A becoming the most favourable.

12.7 Scope of DMRB Stage 3 Assessment

12.7.1 It is proposed that the DMRB Stage 3 assessment for Landscape would be undertaken in accordance with GLVIA3 and cognisant of DMRB LA 107 'Landscape and visual effects' (Highways England et al., 2020b). It should be noted that the Scotland National Application Annex (SNAA) for DMRB LA 107 Landscape and visual effects is not yet published. Once this SNAA is published, it is the intention to adopt the updated guidance during the DMRB Stage 3 assessment and this would be clearly stated in the relevant assessment chapters presented in the EIA Report. It is anticipated the DMRB Stage 3 assessment would include the following:

- Development of methodology to address key stakeholder interests and help maintain consistency of approach across all A9 dualling projects.
- Updated/supplementary baseline landscape assessment, as necessary.
- Detailed landscape assessment to identify the likely effects on key characteristics of the landscape resource and identify what mitigation measures would be necessary to reduce residual effects. Key areas of focus in the assessment would include the new junctions and the design of measures to mitigate the effects of new structures including retaining walls and bridges and effects on the SQ's of the River Tay (Dunkeld) NSA in addition to landscape components of affected GDLs.
- Development of mitigation proposals in accordance with DMRB LD 117 Landscape Design (Highways England et al., 2020c) and Transport Scotland's policy document: Fitting Landscapes: Securing more sustainable landscapes, published in March 2014.
- Detailed landscape impact assessment to take account of detailed mitigation proposals.

12.7.2 In addition, photomontages would be prepared to represent key views at locations to be determined in consultation with NatureScot and PKC.

12.7.3 The scope identified above aligns with the recommendations made in the SEA (Transport Scotland, 2013, 2014a, 2014b) for the DMRB Stage 3 assessment.

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13. Visual

13.1 Introduction

13.1.1 This chapter presents the Design Manual for Roads and Bridges (DMRB) Stage 2 assessment of the proposed route options in relation to the potential impacts and effects on the visual amenity and views experienced by people from publicly accessible viewpoints and nearby buildings including nearby residential properties.

13.1.2 The chapter identifies and describes: the baseline situation within the adopted study area; the potential impacts likely to result from each of the proposed route options (during construction and operation); the potential mitigation measures which could be implemented in order to reduce the effects of each option on the landscape resource; and the predicted residual effects on visual amenity likely to result from each of the proposed route options.

13.1.3 It also provides a comparative assessment of the proposed route options and identifies which are likely to have the least and greatest visual effects. The comparative assessment is provided at the end of this chapter.

13.1.4 The chapter also includes an assessment of the effects on the View from the Road (provided in *Appendix A13.2: View from the Road*) which addresses the predicted effects associated with each option on vehicle travellers. The scope and approach to this assessment is provided within the appendix.

13.1.5 A separate but related landscape assessment, which considers the potential effects on the landscape resource, is reported in Volume 1, Part 3 – Environmental Assessment (Chapter 12: Landscape).

13.1.6 A description of each of the proposed route options assessed is provided in Volume 1, Part 3 – Environmental Assessment (Chapter 7: Overview of Environmental Assessment). The proposed route options comprise:

- Option ST2A (Community's Preferred Route Option);
- Option ST2B;
- Option ST2C: and
- Option ST2D.

13.1.7 The locations of the publicly accessible viewpoints that were visited to inform this assessment are shown on Figure 13.1a-d.

Legislative and Policy Background

13.1.8 Section 12.1 (Introduction - Legislative and Policy Framework) of Volume 1, Part 3 – Environmental Assessment (Chapter 12: Landscape) provides a summary of policies and plans that are relevant to landscape and visual aspects of the proposed route options.

13.2 Approach and Methods

13.2.1 This DMRB Stage 2 visual assessment was undertaken in accordance with DMRB LA 107 'Landscape and Visual Effects' Revision 1 (Highways England et al., 2020), with reference to Guidelines for Landscape and Visual Impact Assessment 3rd Edition (GLVIA3) (The Landscape Institute, 2013).

13.2.2 The approach to the assessment has also been informed by Fitting Landscapes: Securing more Sustainable Landscapes (Transport Scotland, 2014a) and Planning Advice Note (PAN) 1/2013: Environmental Impact Assessment Revision 1 (Scottish Government, 2017). Agreed collective assessment methodology has been developed for the A9 Dualling Programme through consultation with key environmental stakeholders (including NatureScot) and Perth & Kinross Council (PKC).

13.2.3 Impacts on the visual amenity of people can arise at specific locations or from broader areas, the impacts arising from changes in the content and the character of views as a result of change or loss of existing elements of the landscape (e.g. woodland) and/or the introduction of new elements. As part of the DMRB Stage 2 assessment, the assessor is required to make an overall judgement on the impact of each route, allowing for likely or potential mitigation, to inform the route selection process and allow comparison of the proposed route options.

Study Area

13.2.4 The study area within which it is considered that potential significant visual impacts could occur is shown on Figure 13.2. It comprises an area extending up to 5km in distance from the road corridor. Although it is possible that there may be some potential impacts on existing views from receptors at greater distances, these are predicted to be not significant.

13.2.5 Within this 5km study area, Zone of Theoretical Visibility (ZTV) mapping has been prepared for the existing A9 and for each of the proposed route options, as shown on Figures 13.2 and 13.3. These ZTVs were produced using a bare-earth Digital Terrain Model (DTM) and show the maximum extent of the area from which the existing A9 (Figure 13.2) and each proposed route option (Figure 13.3) and vehicles may be visible[1], however, they do not take into account screening or filtering of visibility by local landform features not captured by the DTM, built features or vegetation, which were considered during subsequent site survey work.

13.2.6 As explained later in this assessment, viewpoint locations were selected in consultation with statutory consultees including NatureScot[2] and PKC, and tend to be focussed along the road corridor, close to the existing A9.

Baseline Conditions

13.2.7 The first stage of the assessment was to establish the baseline visual resource against which subsequent change, as a result of the proposed route options, can be identified.

13.2.8 Baseline visual conditions are those that exist at the time of desk and site survey, but also take into account both future changes that are assumed certain (e.g. an approved housing development alongside the existing A9 where construction is yet to commence but would result in changes to existing views), as well as considering likely future changes to the landscape that could affect existing visual amenity (e.g. harvesting and re-stocking of commercial forestry plantations).

<u>Desk-based Assessment</u>

13.2.9 Baseline information was collected through a desk study, including review of the following information sources:

- 1:5,000, 1:10,000, 1:25,000 and 1:50,000 Ordnance Survey (OS) maps;
- Google-Earth web-based photography;

[1] For the 'target' height, the ZTVs add 4.5m to the existing road or proposed route options in order to take into account the movement of traffic, including Heavy Goods Vehicles (HGVs), and potential effects arising from this.
[2] Scottish Natural Heritage (SNH) was rebranded to NatureScot in August 2020.

- aerial photography provided by Transport Scotland (including BLOM Survey, 2014);
- Jacobs Geographic Information Systems (GIS) datasets (obtained through consultation with relevant stakeholders);
- A9 Dualling Programme. Strategic Environmental Assessment (SEA) Report. (Transport Scotland, 2013);
- A9 Dualling Programme. Strategic Environmental Assessment (SEA). Environmental Report Addendum. Appendix F – Strategic Landscape Review Report (Transport Scotland, 2014b);
- A9 Route Improvement Strategy – Dualling of Birnam to Tay Crossing, Stage 2 Options Assessment Report, Part 2 Environmental Assessment produced by AECOM, 2011;
- Perth & Kinross Council: Core Paths Plan (PKC, 2017);
- PKC: Landscape Supplementary Guidance (2020);
- PKC Local Development Plan 2 (2019);
- TAYplan: Strategic Development Plan (2016 – 2036) (TAYplan, 2017);
- The Special Qualities of the National Scenic Areas, Scottish Natural Heritage Commissioned Report No.374 (2010);
- Tayside Landscape Character Assessment: Scottish Natural Heritage Review 122 (1999);
- NatureScot, Landscape Character Assessment in Scotland web page and Landscape Character Types Map and Descriptions (2019);
- a web-based search to identify key views and areas of scenic quality from the existing A9; and
- consultation with the Environmental Steering Group (including PKC and NatureScot).

Site Surveys

13.2.10 Site surveys were carried out in the autumn and winter of 2018 by a team of landscape architects. Information was collected using a standardised checklist, as well as photographs of landscape features that may be physically affected and photographs to/from a selection of key viewpoints that may have potential visibility of the proposed route options, a selection of which are provided on Figures 13.4a-g.

Consultation

13.2.11 A summary of the consultation is reported in Volume 1, Part 3 – Environmental Assessment (Chapter 7: Overview of Environmental Assessment, Section 7.6 (Consultation)). Key consultations that have informed this assessment are summarised in the following paragraph.

13.2.12 Consultation has been undertaken throughout the DMRB Stage 2 assessment process, including with NatureScot and PKC. This has included agreement of the approach to the assessment on this project and on other A9 dualling projects, identification of viewpoint locations, and review of design and landscape options (such as slope gradients and replacement woodland opportunities).

Viewpoint Selection

13.2.13 A list of potential viewpoint locations within the study area was chosen to reflect the views experienced from residential areas, public viewpoints, transport routes and workplaces. These were then visited to confirm or revise locations as necessary, record and photograph the existing baseline views, and consider likely changes resulting from the proposed route options across the whole of the view that might be affected.

13.2.14 Twenty-one viewpoints were identified within the study area and progressed to assessment. These are representative of the location and range of visual receptors (such as residents and people engaged in recreational activities) at publicly accessible locations in the study area. In accordance with good practice they are located at different distances, directions and heights relative to the proposed route options. Potentially, impacts on visual amenity resulting from one or more of the proposed route options would arise at locations that are not publicly accessible. Such locations include residential areas where views from the curtilage or from within the property itself may be impacted upon. Where such instances occur, and where the consideration of the potential impacts over a broader area is considered to be appropriate, the impact is considered as part of the assessment of the representative viewpoint. For example, this approach was adopted in the assessment of Viewpoint 8 Telford Gardens which represents the views from receptors at Telford Gardens in addition to Stell Park Road and King Duncan's Place.

13.2.15 The locations of the viewpoints selected for assessment within the study area are shown on Figure 13.1a-d and listed in *Appendix A13.1: Visual Assessment Tables.*

Assessment of Potential Impacts and Effects

13.2.16 The assessment of potential impacts and effects on visual amenity has been undertaken using the approach outlined below, where the level of significance is assessed based on the sensitivity to change of the visual receptor (taking into account the value of views and susceptibility to change), as well as the magnitude of change that would be experienced during construction and operation of the proposed scheme.

13.2.17 In accordance with DMRB LA 107 and GLVIA3, the assessment of sensitivity for visual assessment combines the susceptibility of the receptor to changes in visual amenity arising from the specific type of development proposed, and the value attributed to the existing views.

Value of Views

13.2.18 Value attached to views can be indicated by the presence of heritage assets and planning designations or expressed through published or interpretive material. The criteria in Table 13.1 were used, along with professional judgement, to help determine the value of the views experienced by each visual receptor.

Table 13.1: Value of Views

Value	Views
High	Views from within or looking towards landscapes of international or national importance, typically recognised by designation or from a highly popular visitor attraction where the view forms an important part of the experience, or where the view has important cultural associations.
Medium	Viewpoints from within or looking towards landscapes of regional/district importance typically recognised by designation, or from a moderately popular visitor attraction where the view forms part of the experience, or where the view has a local cultural association.
Low	Viewpoints within landscapes with no designation, and where a view is not associated with a visitor attraction and has little or no cultural associations.

Visual Receptor Susceptibility

13.2.19 The susceptibility of visual receptors, as defined in GLVIA3, is mainly a function of *'the occupation or activity of people experiencing the view at particular locations; and the extent to which their attention or interest may therefore be focused on the views and the visual amenity they experience at particular locations.'* The criteria in Table 13.2 (based on GLVIA 3) were applied, along with professional judgement, to evaluate the susceptibility of different types of receptors (where applicable, interims of medium/high or low/medium may be used where considered appropriate).

Table 13.2: Visual Receptor Susceptibility to Change

Susceptibility	Receptor Type
High	▪ Residents. ▪ People engaged in outdoor recreation, including users of public rights of way, whose attention is likely to be focused on the landscape and on particular views. ▪ Visitors to heritage assets or other attractions where views of the surroundings are an important part of the experience. ▪ Communities where views contribute to the landscape setting and are enjoyed by residents. ▪ Travellers on Non-Motorised User (NMU) and recognised scenic routes where awareness of views is likely to be particularly high.
Medium	▪ Travellers on road, rail or other transport routes (where there is a general awareness of views).
Low	▪ Travellers on road or rail routes (where awareness of views is likely to be low). ▪ People engaged in outdoor sport or recreation, which does not involve appreciation of views. ▪ People at their place of work, whose attention may be focused on their work and where the setting is not important to the quality of working life.

Evaluation of Visual Receptor Sensitivity

13.2.20 The sensitivity of visual receptors to changes in their views was evaluated in accordance with the criteria provided in Table 13.3. The evaluation is based on professional judgement of a visual receptor's susceptibility to change to a particular view and the value attached to a particular view.

Table 13.3: Visual Receptor Sensitivity to Change

Sensitivity	Criteria
Very High	Receptors where the changed view is of very high value and where the receptor will experience a considerable change to visual amenity by reason of the nature of activity and their expectations.
High	Receptors where the changed view is of high value and/or where the receptor will experience an appreciable change to visual amenity by reason of the nature of activity and their expectations.
Moderate	Receptors where the changed view is valued but not critical to amenity and/or the nature of the view is valued but not a primary consideration of the users (receptors where users are likely to spend time outside of participation in their activity looking at the view and users of workplaces with windows that take advantage of views).
Low	Receptors where the changed view is unimportant and/or users are not sensitive to change (receptors where users are unlikely to consider the views an important element of their activity will generally be assessed to be of low sensitivity).
Negligible	Receptors where the changed view is quick and transient. Receptors where the changed view is from industrial areas, land awaiting development, or from landscapes of no importance with no variety or distinctiveness.

Magnitude

13.2.21 As noted in GLVIA3, the magnitude of visual effect that would be experienced by the identified visual receptors relates to the size or scale of change, its geographical extent, and the duration and reversibility of change. The nature of change, distance, screening and the direction and focus of the view are also important considerations.

13.2.22 The magnitude of visual effect was assessed on a five-point scale, taking account of the degree of visual change that would take place as a result of the proposed scheme using the criteria provided in Table 13.4, along with professional judgement. The permanent operation-phase effects of the proposed scheme are of long-term duration and largely irreversible so are considered of greater magnitude than temporary construction-phase effects such as those arising from haul roads, which are typically short-term and reversible.

Table 13.4: Magnitude of Visual Effect

Magnitude	Criteria
Major	Where the proposed route option or elements of the route will dominate the view and fundamentally change its character and components over a large geographic area.
Moderate	Where the proposed route option or elements of the route will dominate the view and considerably change its character and components over a notable geographic area.
Minor	Where the proposed route option or elements of the route will be noticeable in the view, affecting its character and altering some of its components and features over a notable geographic area.
Negligible	Where the proposed route option or elements of the route will be a minor part of the overall view, over a small geographic area, and may be missed by the casual observer and/or scarcely appreciated.
No change	No perceptible change in the overall view.

Significance of Visual Effects

13.2.23 The significance of visual effects has been determined through professional judgement, with reference to the significance matrix set provided below in Table 13.5 (and as set out in Table 3.8.1 of DMRB LA 104 'Environmental assessment and monitoring' (Highways England et al., 2020b). The determination of the significance of effect has been based on consideration of both the sensitivity of the visual receptors to changes in their views and the predicted magnitude of change as a result of the proposed scheme. Significance is defined as Neutral, Slight, Moderate, Large or Very Large, in addition to being either adverse or beneficial as shown in Table 13.6. Effects of Moderate significance or greater are considered to be significant in the context of this assessment and mitigation would generally be required to reduce these where practicable.

Table 13.5: Significance Matrix

Magnitude / Visual Sensitivity	No change	Negligible	Minor	Moderate	Major
Very High	Neutral	Slight	**Moderate** or Large	**Large** or **Very Large**	**Very Large**
High	Neutral	Slight	Slight or **Moderate**	**Moderate** or **Large**	**Large** or **Very Large**
Medium	Neutral	Neutral or Slight	Slight	**Moderate**	**Moderate** or **Large**
Low	Neutral	Neutral or Slight	Neutral or Slight	Slight	Slight or **Moderate**
Negligible	Neutral	Neutral	Neutral or Slight	Neutral or Slight	Slight

Table 13.6: Significance of Visual Effects

Significance	Criteria
Very Large	Adverse: The proposed scheme would cause major deterioration to a view or loss of a view from a very highly sensitive receptor and would constitute a major discordant element in the view. Beneficial: The project would lead to a major improvement in a view from a very highly sensitive receptor.
Large	Adverse: The project would cause major deterioration to a view or loss of a view from a highly sensitive receptor and/or would constitute a major discordant element in the view. Beneficial: The project would lead to a major improvement in a view from a highly sensitive receptor.
Moderate	Adverse: The project would cause obvious deterioration to a view from a moderately sensitive receptor, or perceptible damage to a view from a more sensitive receptor. Beneficial: The proposals would cause obvious improvement to a view from a moderately sensitive receptor, or perceptible improvement to a view from a more sensitive receptor.
Slight	Adverse: The project would cause limited deterioration to a view from a receptor of medium sensitivity or cause greater deterioration to a view from a receptor of low sensitivity. Beneficial: The project would cause limited improvement to a view from a receptor of medium sensitivity or would cause greater improvement to a view from a receptor of low sensitivity.
Neutral	No perceptible change in the view.

View from the Road

13.2.24 View from the road can be defined as being the extent to which travellers, including drivers, are exposed to different types of scenery through which a route, or proposed route options, pass. Its assessment requires consideration of the scenery or landscape character through which the route(s) pass, the extent of views that are possible from the route, the quality of the landscape and features of particular interest or prominence which might be experienced in views from the route(s).

13.2.25 The assessment of significance of effects on the View from the Road is provided in *Appendix A13.2: View from the Road*. Consideration of the potential effects likely to arise from the proposed route options has been one of the factors that has informed the development of the indicative conceptual landscape mitigation proposals provided in Figures 12.4 to 12.7. Consideration of the predicted effects on the view from the road has also informed the assessment of effects on the special qualities of the River Tay (Dunkeld) National Scenic Area presented in *Appendix A12.1: Assessment of Predicted Effects on the River Tay (Dunkeld) National Scenic Area*.

13.2.26 The comparative assessment of the proposed route options on the View from the Road is provided in Section 13.6 (Summary of Route Options Assessment).

Community Objectives

13.2.27 At an early stage in the A9 Co-Creative Process, the Birnam to Ballinluig A9 Community Group generated community objectives. The seven objectives are presented in Volume 1, Part 3 – Environmental Assessment (Chapter 7: Overview of Environmental Assessment) and cover a wide range of topics but focus predominantly on environmental issues.

13.2.28 The community objectives have been taken into consideration throughout the DMRB Stage 2 assessment process and a mapping exercise was conducted to indicate how, in the operational phase, the proposed route options could contribute to the relevant objectives. Details of how each environmental topic contributes towards achieving the community objectives is presented in *Appendix A7.1: Mapping of Community Objectives Against DMRB Stage 2 Route Options* and a summary for this chapter is presented in Section 13.6 (Summary of Route Options Assessment).

Limitations to Assessment

13.2.29 The assessment was based on desk-based and field assessments using representative receptor locations to enable comparison of the proposed route options. Section 13.6 (Summary of Route Options Assessment) takes into account indicative conceptual landscape mitigation proposals prepared for each of the proposed route options (Figures 12.4 to 12.7) in addition to other mitigation proposals as described in Volume 1, Part 3 – Environmental Assessment (Chapter 12: Landscape), Section 12.5 (Potential Mitigation). These conceptual landscape mitigation proposals have not been developed in detail and may be subject to change following further design development at DMRB Stage 3. A more detailed survey and assessment would be carried out at DMRB Stage 3, following the selection of the Preferred Route Option, and would help to inform the development of detailed mitigation proposals.

13.3 Baseline Conditions

Visual Receptors

13.3.1 Visual receptors within the study area comprise residential properties, road users, rail travellers, walkers and cyclists as well as visitors to places of interest. From many locations, views of the existing A9 are partially restricted by mature mixed woodland bordering the road corridor; however, views of the carriageway are possible from elevated locations or where the woodlands are thinned.

13.3.2 The location and a description of visual receptors considered as part of this assessment are provided below. Where applicable, the viewpoints which provide a representative view from the receptor locations have been identified.

Residential Receptors

13.3.3 The main settlements within the study area comprise Dunkeld on the north bank of the River Tay, and Little Dunkeld and Birnam, which lie close to each other, on the south bank of the River Tay. The village of Inver lies to the west of Little Dunkeld and the hamlet of Inchfield to the north of the study area. In addition to these settlements, scattered clusters of properties and individual farmsteads are located on the lower hill slopes and along the valley floor.

Dunkeld (Viewpoint 10)

13.3.4 The town of Dunkeld lies on the northern bank of the River Tay. The town is set within mature woodlands, which cover the surrounding hills and line the river valley. It contains the historically important Dunkeld Cathedral, and the renowned 19th century Dunkeld Bridge (designed by Thomas Telford) forms an important crossing point for the River Tay.

13.3.5 The existing A9 lies to the south of the settlement at a distance of approximately 0.5km. Views from the town are generally short-distance and internal in nature with more long-distance views obtained from locations close to the river where attention is focussed upon the wooded hills surrounding the town and linear views along Strath Tay. Views of the existing A9 road corridor are generally screened by mature woodland that lines the banks of the River Tay. However, since the recent felling of a tall conifer plantation between the River Tay and the A9 just west of the River Braan, filtered views of traffic on the A9 from the Cathedral grounds have been opened up (Viewpoint 10 on Figure 13.4d).

Birnam and Little Dunkeld (Viewpoints 6, 7, 8 and 11)

13.3.6 The town of Birnam and the adjacent settlement of Little Dunkeld, lie on the southern bank of the River Tay to the south of Dunkeld. Birnam is bounded by the steep wooded Birnam Hill to the south. The existing A9 and the Highland Main Line railway form a similarly aligned transport corridor delineating the southern boundary of the town, with Dunkeld & Birnam Station (Viewpoint 7 on Figure 13.4c) located at the base of Birnam Hill.

13.3.7 Views from the town are generally short in range. Longer-distance views can be obtained close to the river, where views are focussed upon the wooded hills surrounding the town and linear views along the River Tay. The A9 runs along the southern edge of the settlement and is set on embankment adjacent to Birnam and in cutting adjacent to Little Dunkeld. Views towards the A9 from the town are generally screened by landform, buildings and roadside trees. Representative views from Birnam and Little Dunkeld towards the existing A9 are provided in Photograph 13.1 and on Figures 13.4b-d (Viewpoints 6, 8 and 11).

Photograph 13.1: View looking south-east towards the existing A9 from Perth Road, Birnam

Inver (Viewpoints 13 and 15)

13.3.8 Inver (Viewpoints 13 and 15 on Figures 13.4d-e) is a small village located on a low-lying wooded strip of land between the southern bank of the River Tay and the northern bank of the River Braan. The existing A9 corridor runs to the north of the village on embankment at a distance of approximately 0.1km, with views of the existing A9 largely screened by the intervening roadside woodland, although some properties on the northern edge of the settlement experience relatively open views of the road corridor.

Inchfield and Inchmagrannachan Farm (Viewpoint 21)

13.3.9 The linear hamlet of Inchfield and Inchmagrannachan Farm (Viewpoint 21 on Figure 13.4g) and holiday cottages are located to the north of the study area set along the western side of the B898. The properties are orientated eastwards within an open landscape, and long-distance views are focussed across Strath Tay. Views of traffic on the existing A9 are in part filtered or screened by roadside vegetation. The River Tay Crossing is also obliquely visible from the settlement, seen within the setting of the wooded valley to the south.

Other Residential Receptors (Viewpoints 1 and 12)

13.3.10 Scattered individual residential properties and farms are also found within the study area. A number of these properties are oriented to take advantage of long-distance views along and across Strath Tay.

13.3.11 Deans Bank, Roman Bridge Cottage, Ringwood Cottage, Ringwood and Bee Cottage are properties within and to the west of Murthly Castle Garden and Designed Landscape (GDL) (Viewpoint 1 on Figure 13.4a) that are set within woodland, which reduces their existing visibility of the A9. On the northern bank of the River Tay close to Dunkeld, the properties of Clunie Cottage, Eastwood and Eastferry also have views of the existing A9 restricted by intervening woodland, whilst Haughend, which lies above the Old Military Road, experiences some filtered views towards the existing A9 route corridor.

13.3.12 Properties at Ladywell (Viewpoint 12 on Figure 13.4d) and Ladywell Cottage, which lie to the west of Little Dunkeld, are set within a more open landscape; however, the ZTV on Figure 13.2 indicates that existing views towards the A9 from these locations are limited by intervening landform.

Road Users

A822 (Old Military Road) (Viewpoints 12 and 14)

13.3.13 The A822 (Old Military Road) follows the historic route of the Old Military Road along Strathbraan and joins the existing A9 approximately 0.3km to the west of Little Dunkeld. The route rises from the Tay valley and passes through farmland set to pasture, which allows for largely open views. However, on the section of the A822 (Old Military Road) closest to the existing A9 route corridor, from the rail bridge to Ladywell (Viewpoints 12 and 14 on Figures 13.4d-e), the undulating landform limits views towards the existing A9.

A923

13.3.14 The A923 is the main route from Dunkeld to Blairgowrie and joins the existing A9 at Little Dunkeld. The route crosses the River Tay at Dunkeld Bridge, passes through the centre of Dunkeld, and continues uphill through woodland and farmland lined with roadside trees. Filtered views of the A9 may be obtained from some locations close to the river by southbound travellers but in general views towards the existing A9 from the A923 are screened by intervening vegetation.

A984 (Viewpoint 3)

13.3.15 The A984 runs east from the centre of Dunkeld along the northern bank of the River Tay to Caputh. The ZTV on Figure 13.2 indicates potential visibility of the existing A9 corridor from much of the A984; however, from Dunkeld to Newtyle the land to the south of the A984 is heavily wooded and thus views of the existing A9 are screened by the intervening vegetation. To the east of Newtyle the landscape becomes more open but here views are limited by the roadside vegetation bounding the A9. A representative view from the A984 towards the existing A9 is provided in Photograph 13.2 and Figure 13.4a (Viewpoint 3).

Photograph 13.2: View looking south-west towards the existing A9 from the A984 near Newtyle Farm (Viewpoint 3)

B867 (Viewpoint 4)

13.3.16 Prior to construction of the existing A9, the B867 was the original main route between Perth and Dunkeld and runs through the Pass of Birnam. The road passes under the Highland Main Line railway bridge to the north of the Pass, and then runs parallel with both the railway to the south and the existing A9 to the north for approximately 2km until terminating at a wide at-grade T-junction with the existing A9, 0.4km to the south of Birnam (Viewpoint 4 on Figure 13.4b). The B867 is edged by woodland and views to both the rail line and the existing A9 are filtered by trees.

B898 (Viewpoint 21)

13.3.17 The B898 joins with the existing A9 immediately to the south of the River Tay crossing within the northern part of the study area and continues north along the western bank of the River Tay passing the linear hamlet of Inchfield and Inchmagrannachan (Viewpoint 21 on Figure 13.4g). The road follows the edge of the flat River Tay floodplain and initially passes through woodland at its southern end, which opens out to fields set to pasture surrounded by low wooded hills. Views to the existing A9 are partial and glimpsed through intervening vegetation, with the River Tay crossing seen in oblique views along Strath Tay to the south.

Minor Roads (Viewpoint 6)

13.3.18 The Old Military Road runs parallel to the A984 within and to the east of Dunkeld and continues along its route to join the A984. It is mostly enclosed by dense woodland and roadside trees and views towards the existing A9 are limited by intervening vegetation on either side of the River Tay.

13.3.19 Perth Road runs through Birnam (Viewpoint 6 on Figure 13.4b) and Little Dunkeld and is enclosed by buildings within these settlements, roadside vegetation, dense woodland and the surrounding hills. Views along the road are directed by the built form and vegetation towards more distant hills in the west and visibility of the existing A9 is limited.

Rail Users

Highland Main Line railway (Viewpoint 7)

13.3.20 The Highland Main Line railway follows a broadly similar route to the existing A9, running in parallel with it and alternating to the north and south of the road corridor through the study area.

13.3.21 From the Pass of Birnam to the foot of Creag na Buire, the two routes are separated by a strip of dense woodland, which restricts views. North of this point, the Highland Main Line railway and existing A9 run in close parallel for approximately 2km, passing the settlements of Birnam and Little Dunkeld, which are served by Dunkeld & Birnam Station (Category A Listed Building). Over this stretch of the shared route corridor, the proximity of the two routes ensures that there are clear views of the existing A9 for rail travellers and vice versa.

13.3.22 To the north of Little Dunkeld, the routes then diverge with the Highland Main Line railway taking a route to the south of Inver, passing over the River Braan and through a tunnel that cuts under the existing A9. The two routes then converge and run close together along the western side of the Tay valley, with the existing A9 on the more elevated route, until just south of the River Tay crossing. The route corridor is shared over a section of approximately 2km, allowing rail passengers to obtain mostly undisrupted views of the A9. A representative view towards the existing A9 from the footbridge at Dunkeld & Birnam Station is provided in Photograph 13.3 and also in Viewpoint 7 on Figure 13.4c.

Photograph 13.3: View looking north towards the existing A9 from the Dunkeld & Birnam Station Footbridge (Viewpoint 7)

Cyclists on Designated Routes

National Cycle Network Route 77 (NCR 77) (Viewpoints 4, 17, 19, 20 and 21)

13.3.23 NCR 77 runs between Dundee and Pitlochry via Perth and is known as the Salmon Run route. In the southern part of the study area the route follows the B867 north from the Pass of Birnam to the junction with the existing A9 (Viewpoint 4 on Figure13.4b). NCR 77 then changes to an off-road cycle path, which runs adjacent to the existing A9 and Highland Main Line railway and passes underneath the existing A9 at Birnam Glen beside Dunkeld & Birnam Station, turning east to follow the A923 across Dunkeld Bridge. At Stanley Hill in Dunkeld the cycle route leaves the main road and follows an off-road path through Cathedral Park and downhill to the grounds of the Dunkeld House Hotel (Viewpoint 17 on Figure 13.4f). The route then skirts the east bank of the River Tay on an off-road path, surrounded by dense woodland, and reaches the northern boundary of the study area by passing underneath the River Tay crossing.

13.3.24 Direct views to the existing A9 are obtained from NCR 77 along a short section that runs adjacent to the existing A9, from the junction with the B867 to the turning for Birnam. Views are open, with the sparse roadside vegetation allowing cyclists clear views of the main carriageway and traffic. Over much of the rest of the route, views to the existing A9 are filtered by intervening vegetation either surrounding the cycle route or by the roadside trees adjacent to the A9. In the northern section of the route, direct views of the River Tay crossing are obtained by users of NCR 77 as it approaches the bridge before passing underneath. Representative views from NCR 77 towards the existing A9 where it crosses the River Tay are provided in Photograph 13.4 and also in Viewpoints 19 and 20 on Figures 13.4f-g.

Photograph 13.4: View looking north-west towards the existing A9 from NCR77, south of the Tay Crossing (Viewpoint 17)

Regional Cycle Route 83 (RCR 83)

13.3.25 RCR 83 runs from the north of Dunkeld to beyond the northern extents of the study area. It is in part located within Dunkeld House GDL and the majority of RCR 83 runs through dense woodland, limiting visibility beyond the route extents.

Walkers on Designated Routes (Viewpoints 6, 9, 13, 14, 15, 16, 17, 18, 19 and 20)

13.3.26 Within the study area, Core Paths generally coincide with local roads and tracks, and cover the hills and the banks of the Rivers Tay and Braan. Core Paths on hill slopes within the study area largely pass through woodland (for example DUNK/102/1 and DUNK/65/1), where views of the existing A9 are therefore limited. Similarly, views from the Core Paths that follow the banks of the River Tay (such as DUNK/145/2 and DUNK/25/3 (Viewpoints 17 and 19 on Figure 13.4f)) are generally restricted, with glimpsed views to the route corridor from some locations that are more open in nature.

13.3.27 Direct views towards the existing A9 are obtained from Core Path DUNK/142/2 which runs adjacent to the A9 from the junction with the B867 to the turning for Birnam. From this path views are open, allowing walkers to experience clear views of the main carriageway. Direct views of the existing A9 would also be experienced from some locations by walkers on the Core Paths surrounding Inver.

Cultural and Recreational Receptors (Viewpoints 1, 10, 11, 16, 17 and 18)

13.3.28 Murthly Castle estate (Viewpoint 1 on Figure 13.4a) is a historically important, Inventory Garden and Designed Landscape (GDL) and also a visitor attraction supporting corporate events and weddings at the Castle as well as fishing, shooting and woodland walking routes throughout its grounds. Views from the estate to the existing A9 are possible in some locations but tend to be limited by dense woodland.

13.3.29 Dunkeld Cathedral (Viewpoint 10 on Figure 13.4d) is a historically important cathedral where the setting and visual amenity experienced are an aspect of the visit (refer to Volume 1, Part 3 – Environmental Assessment (Chapter 14: Cultural Heritage)). It falls within the Dunkeld House GDL, the grounds of which include many footpaths from which views across the River Tay can be experienced. Views to the existing A9 west of where it crosses the River Braan are obtained looking south across the River Tay from the cathedral grounds with further views of the existing A9 where it passes below Craig Vinean experienced west of what is now the Dunkeld House Hotel.

13.3.30 Birnam Highland Games Park (Viewpoint 11 on Figure 13.4d) lies on the western edge of the town, bordered by the River Tay to the north, the River Braan to the west and the existing A9 to the south. The park encompasses tennis courts and a bowling green and is also used for general recreation and as the site of the annual Birnam Highland Games. Filtered views of the existing A9 can be experienced from the Park.

13.3.31 The Hermitage (Viewpoint 16 on Figure 13.4e) is an Inventory GDL, managed by the National Trust for Scotland and is a popular visitor attraction incorporating a folly, waterfall and woodland walks. The Hermitage car park is located within the woodland, adjacent to the existing A9. Glimpsed views of the existing A9 are possible from the car park, however, from locations further into the GDL views tend to be screened by woodland.

13.3.32 The Pine Cone viewpoint (Viewpoint 18 on Figure 13.4f) is a modern folly situated on the northern slopes of Craig Vinean within Craigvinean Forest and has an elevated view along Strath Tay. The viewpoint overlooks the existing A9 route to the north and has views filtered by trees to the east.

Summary of Representative Visual Receptors

13.3.33 Table 13.7 provides a summary of the assessed representative viewpoints, including assessment of the sensitivity to visual change for receptors at each of the locations.

Table 13.7: Representative Viewpoints

Representative Viewpoint	Receptor Type	Value	Susceptibility	Sensitivity
1: West Entrance to Murthly Castle Garden and Designed Landscape	road users, visitors	High	Medium	Moderate
2: A9 Lay-by near Ringwood	road users	High	Low	Moderate
3: A984, near Newtyle Farm	road users	High	Low	Moderate
4: B867/NCR 77	road users, cyclists	High	Medium	Moderate
5: South-west of Newtyle Hill	walkers	High	High	High
6: Junction of Perth Road/Station Road and Core Path, Birnam	residents, road users, walkers	High	High	High
7: Footbridge at Dunkeld & Birnam Station (Highland Main Line railway)	rail users	High	Medium	High
8: Telford Gardens, Little Dunkeld	residents	High	High	High
9: Summit of Craig a Barns	walkers	High	High	High
10: Dunkeld Cathedral and Grounds	visitors	High	High	High
11: Birnam Highland Games Park	visitors	High	High	High
12: A822 (Old Military Road) at Ladywell	residents, road users	High	High	High
13: Inver Bridge and Core Path	road users, walkers	High	High	High
14: A822 (Old Military Road), approaching Little Dunkeld	road users	High	Low	Moderate
15: Core Path, northern edge of Inver	residents, walkers	High	High	High
16: Car park at The Hermitage GDL	walkers, visitors	High	High	High
17: Core Path south of Dunkeld House Hotel GDL and NCR 77	walkers, cyclists	High	High	High
18: Pine Cone Viewpoint	walkers, visitors	High	High	High
19: Core Path and NCR 77, south of Tay Crossing	walkers, cyclists	High	High	High
20: Core Path and NCR 77, north of Tay Crossing	walkers, cyclists	High	High	High
21: B898 and NCR77, Inchmagrannachan Farm	residents, road users, cyclists	High	High	High

View from the Road

13.3.34 A description of the baseline conditions to the View from the Road is provided in *Appendix A13.2 (View from the Road)* which describes the sequence of views experienced by vehicle travellers for both northbound and southbound journeys between the Pass of Birnam and the Tay Crossing with reference to the special qualities of the River Tay (Dunkeld) National Scenic Area (NSA).

13.4 Potential Impacts and Effects

13.4.1 This section describes the potential visual impacts and effects for each of the proposed route options during construction and operation which would have the potential to affect visual receptors such as residents and vehicle travellers.

13.4.2 The potential impacts and effects reported are those in the absence of mitigation measures, which would be developed in detail as part of the DMRB Stage 3 design and assessment. However, it should be noted that some aspects that influence landscape such as grading out of embankments or alignment to reduce woodland loss have been considered as early 'embedded' mitigation through the DMRB Stage 2 design process and as such are incorporated within each of the proposed route option designs as presented and assessed in this DMRB Stage 2 assessment report.

13.4.3 Further assessment, taking into account indicative conceptual landscape mitigation proposals (Figures 12.4 to 12.8) described in Section 12.5 in Volume 1, Part 3 – Environmental Assessment (Chapter 12: Landscape), in addition to the 'embedded' mitigation measures, is provided in Section 13.6 (Summary of Route Options Assessment).

Construction

13.4.4 The construction activities associated with road schemes have the potential to cause temporary adverse visual impacts on receptors. All of the proposed route options would have the potential for impacts on visual amenity during construction as a result of the following:

- removal of vegetation along the A9 corridor;
- vehicles moving machinery and materials to and from the site;
- machinery, potentially including heavy excavators and earth moving plant;
- exposed bare earth over the extent of the proposed works;
- structures, earthworks, road surfacing and ancillary works during construction;
- temporary soil storage heaps and stockpiles of construction materials;
- site compound areas;
- lighting associated with night-time working and site accommodation;
- traffic congestion and queueing during work to tie new road with existing road;
- temporary works associated with bridge construction operations; and
- traffic management measures.

13.4.5 The potential construction impacts of all proposed route options would be likely to be similar between ch0 and ch400 and from ch4800 to the end of the proposed route options. Potential impacts on visual amenity during construction between ch400 and ch4800 would vary for each of the proposed route options.

13.4.6 For Option ST2A, there would be the potential for visual impacts to occur during the construction of the cut and cover tunnel particularly at the existing Birnam Industrial Estate where the proposed tunnel would be close to residential receptors on Station Road, Birnam Terrace and Gladstone Terrace. There is potential for visual impacts to also arise as a result of the construction of the Dunkeld Junction roundabout, realigned B867 and the Murthly Junction (including overbridge), all of which would result in visual disruption during construction. The lowering of Inchewan Burn and the construction of a new culvert to carry the watercourse under the proposed route option using bored piles and retaining walls would have the potential to result in visual impacts on the visual amenity of nearby residential receptors along Birnam Glen. There would also be potential for impacts on visual amenity as a result of the concrete batching and mud plants associated with Option ST2A. The construction phase for Option ST2A has an estimated duration of 4.5 to 5 years.

13.4.7 For Option ST2B, construction of the roundabout at Little Dunkeld would have a similar visual impact to that of Option ST2A. However, the construction of the approximately 150m long A9 underpass (which is considerably shorter than the tunnel) would result visual impacts of a lesser magnitude than the tunnel albeit that where they do occur, the resultant visual effects are likely to be significant. The potential for visual impacts would also arise from the construction of the grade separated Birnam Junction. The lowering of Inchewan Burn and the construction of a new culvert to carry the watercourse under the proposed route option using bored piles and retaining walls would have the potential to result in visual impacts on the visual amenity of residential receptors close to Inchewan Burn. The construction phase for Option ST2B has an estimated duration of 4 to 4.5 years.

13.4.8 For Option ST2C, construction of the Dunkeld & Birnam Station pedestrian underpass, replacement car park would also have the potential to result in visual impacts but of a lesser category than the potential visual impacts likely to arise from construction of the cut and cover tunnel associated with Option ST2A and the underpass (approximately 150m long) associated with Option ST2B. The potential for visual impacts would result from the construction of the grade separated Dunkeld Junction, in addition to the construction of the new bridge crossing over the River Braan. The potential for visual impacts arising from the construction of Dunkeld Junction would be likely to be of greater magnitude where viewed from locations within Little Dunkeld such as Telford Gardens and King Duncan's Place. Potential impacts arising from the construction of the new bridge crossing at the River Braan and associated large-scale embankment would be most notable where viewed from Dunkeld Cathedral and grounds. The potential for visual impacts would arise from the construction of the grade separated Birnam Junction. The construction phase for Option ST2C has an estimated duration of 2.5 to 3 years.

13.4.9 For Option ST2D, construction of the Dunkeld & Birnam Station pedestrian underpass and replacement car park would have the potential to result in impacts on visual amenity, but of a lesser category than the potential visual impacts resulting from the cut and cover tunnel associated with Option ST2A and the underpass associated with Option ST2B, whilst the construction of the Dunkeld Junction roundabout would have similar visual impacts to Options ST2A and ST2B. The potential for visual impacts would also arise from the construction of the grade separated Birnam Junction. The construction phase for Option ST2D has an estimated duration of 2.5 to 3 years.

Operation

13.4.10 Potential impacts on visual amenity during operation are described below for each proposed route option. All potential impacts are considered adverse unless otherwise stated. The majority of potential impacts would be as a result of one or more of the following:

- introduction of increased road surface and associated infrastructure, lighting, barriers, fencing, signage etc;
- addition of two more lanes of traffic which would increase traffic visibility;
- loss of screening vegetation for residential properties;

- changed appearance of the landform along the road corridor as a result of large-scale earthworks and/or rock cuttings and the potential requirement for reinforced slopes and/or retaining structures within the landscape;
- redesign and upgrading of the Murthly Junction (Option ST2A) or Birnam Junction with the B867 (Options ST2B, and ST2C, ST2D);
- introduction of a 1.5km online cut and cover tunnel and replacement station car park (Option ST2A);
- the lowering of Inchewan Burn and the introduction of a new culvert (Options ST2A and ST2B);
- introduction of a 150m underpass and replacement station car park (Option ST2B);
- introduction of a pedestrian underpass and replacement station car park (Options ST2C and ST2D);
- redesign and upgrading of the A822 (Old Military Road)/A923 Dunkeld Junction (with a roundabout in Options ST2A, ST2B and ST2D or a grade separated arrangement in Option ST2C);
- introduction of new crossings across the rivers Braan and Tay;
- introduction of Sustainable Drainage Systems (SuDS) features along the route; and.
- alteration of vegetation patterns and field patterns as a result of tree loss and stripping of groundcover vegetation and topsoil, followed by reinstatement and new planting.

13.4.11 The potential for visual impacts on the representative viewpoints with 'embedded' mitigation are detailed in *Appendix A13.1: Visual Assessment Tables* and are summarised in Table 13.7.

13.4.12 Earthwork mitigation measures 'embedded' within the design of the proposed route options, including alignment and use of retaining structures to reduce woodland loss are taken into account in the assessment of potential impacts and effects. Without these embedded mitigation measures in place, impacts would be greater than those reported in Table 13.7. All potential impacts and their potential resulting effect are considered adverse unless otherwise stated.

Table 13.7: Potential Visual Impacts and Effects on Representative Viewpoints (with 'embedded' mitigation)

Representative Viewpoint	Assessment	Option ST2A	Option ST2B	Option ST2C	Option ST2D	Description of Potential Impact/Effect and the Elements Visible
1: West Entrance to Murthly Castle Garden & Designed Landscape	*Sensitivity: Moderate Magnitude:*	Major	Moderate	Moderate	Moderate	Option ST2A: Notable change to existing view with the introduction of a grade separated junction, overbridge and SuDS with associated loss of woodland and earthworks. Options ST2B, ST2C, and ST2D: The introduction of the proposed underbridge and SuDS would result in a limited loss of roadside woodland and opening of views along the A9.
	Significance	**Large**	**Moderate**	**Moderate**	**Moderate**	
2: A9 Lay-by near Ringwood	*Sensitivity: Moderate Magnitude:*	Major	Moderate	Moderate	Moderate	Option ST2A: Offline realignment of the widened A9 and associated cuttings, resulting in changes to the existing landform and the loss of a significant number of mature roadside AWI trees. Visibility to the Murthly Junction to the south and tunnel entrance to the north. Options ST2B, ST2C and ST2D: Offline realignment of the widened A9 and associated cuttings resulting in the loss of a number of mature roadside AWI trees. Visibility of the Birnam Junction and associated earthworks to the north.
	Significance	**Large**	**Moderate**	**Moderate**	**Moderate**	
3: A984, near Newtyle Farm	*Sensitivity: Moderate Magnitude:*	Minor	Minor	Minor	Minor	All proposed route options: Some increased visibility of vehicles on the A9 and junctions due to loss of intervening AWI woodland, particularly where sections of the widened mainline and proposed slip roads are elevated or run on embankment.
	Significance	Slight	Slight	Slight	Slight	
4: B867/NCR 77	*Sensitivity: Moderate Magnitude:*	Moderate	Major	Major	Major	Option ST2A: Proposed B867 realignment, SuDS and associated earthworks visible, with limited loss of AWI woodland. Proposed tunnel control building visible on top of tunnel. Partial visibility to Murthly overbridge. Options ST2B, ST2C and ST2D: Proposed B867 underbridge, SuDS and grade separated junction with associated large-scale earthworks and significant loss of mature AWI woodland.
	Significance	**Moderate**	**Large**	**Large**	**Large**	
5: South-west of Newtyle Hill	*Sensitivity: High Magnitude:*	Minor	Moderate	Moderate	Moderate	Option ST2A: Increased visibility to the widened A9, realigned B867 and proposed SuDS. Partial views to Murthly overbridge. Options ST2B, ST2C and ST2D: Increased visibility to the widened A9, junctions and side roads, particularly at the Birnam Junction where the introduction of the proposed SuDS would result in a noticeable loss of screening AWI woodland.
	Significance	Slight	**Moderate**	**Moderate**	**Moderate**	

Representative Viewpoint	Assessment	Option ST2A	Option ST2B	Option ST2C	Option ST2D	Description of Potential Impact/Effect and the Elements Visible
6: Junction of Perth Road/Station Road and Core Path, Birnam	*Sensitivity: High Magnitude:*	Moderate	Moderate	Moderate	Moderate	Options ST2A and ST2B: Reduced visibility of vehicles on A9, as A9 would be in tunnel/underpass/cutting. Loss of trees at southern end of Station Road and views to replacement station car park. Options ST2C and ST2D: Partial visibility of replacement station car park and loss of trees at southern end of Station Road leading to slightly increased visibility of A9 traffic.
	Significance	**Moderate**	**Moderate**	**Moderate**	**Moderate**	
7: Footbridge at Dunkeld & Birnam Station	*Sensitivity: High Magnitude:*	Moderate	Moderate	Major	Major	Options ST2A and ST2B: Replacement station car park on top of the proposed tunnel/underpass visible from this elevated viewpoint due to the limited separation distance and lack of intervening vegetation. Widened mainline and associated southbound retaining wall and traffic to south-east of the proposed underpass visible for Option ST2B. Options ST2C and ST2D: Widened A9 clearly visible from this elevated viewpoint due to the close proximity of the road and lack of intervening vegetation. Removal of roadside vegetation adjacent to the southbound carriageway and visibility to the replacement station car park.
	Significance	**Moderate**	**Moderate**	**Large**	**Large**	
8: Telford Gardens, Little Dunkeld	*Sensitivity: High Magnitude:*	Moderate	Moderate	Major	Minor	Option ST2A: Reduced visibility of vehicles on A9 from the rear side aspect of properties, as A9 would be in tunnel/cutting. Impacts are predicted to increase from rear aspects of King Duncan's Place due to loss of woodland where the road exits the tunnel. Front aspect views would be largely unaffected due to intervening buildings and garden vegetation. Option ST2B: Visibility of vehicles on A9 would be reduced, but this would be combined with a loss of roadside vegetation directly adjacent to the rear gardens of residential properties. Option ST2C: Increased visibility of vehicles on the A9 from the rear side aspect of properties due to loss of roadside woodland. Increased visibility of raised and widened mainline, and of slip roads associated with the new Dunkeld Junction. Loss of mature trees due to SuDS at eastern end of Stell Park Road. Visibility to noise barriers from southern aspects of properties at Telford Gardens and King Duncan's Place. Option ST2D: Little change with minor loss of roadside vegetation.
	Significance	**Moderate**	**Moderate**	**Large**	Negligible	
9: Summit of Craig a Barns	*Sensitivity: High Magnitude:*	Minor	Minor	Minor	Minor	All proposed route options: Limited views to the A9 due to screening from dense coniferous forestry covering Craig a Barns.
	Significance	Slight	Slight	Slight	Slight	

Representative Viewpoint	Assessment	Option ST2A	Option ST2B	Option ST2C	Option ST2D	Description of Potential Impact/Effect and the Elements Visible
10: Dunkeld Cathedral and Grounds	*Sensitivity: High Magnitude:*	Moderate	Moderate	Major	Moderate	Options ST2A, ST2B and ST2D: Views to vehicles on the A9 and small-scale embankment to west of River Braan. Option ST2C: Views to vehicles on the elevated A9 and large-scale embankment to west of River Braan.
	Significance	**Moderate**	**Moderate**	**Large**	**Moderate**	
11: Birnam Highland Games Park	*Sensitivity: High Magnitude:*	Moderate	Moderate	Major	Moderate	Options ST2A, ST2B and ST2D: Introduction of new at-grade River Braan crossing and new Dunkeld Junction roundabout would increase visibility of traffic and lead to the loss of mature vegetation on the southern boundary of the park. Option ST2C: Increased visibility of vehicles on the A9 due to the loss of mature vegetation on the southern boundary of the Park, the raised vertical alignment of the mainline above existing grade, introduction of the Dunkeld Junction with associated retaining wall and the limited separation distance from the viewpoint.
	Significance	**Moderate**	**Moderate**	**Large**	**Moderate**	
12: A822 (Old Military Road) at Ladywell	*Sensitivity: High Magnitude:*	Minor	Minor	Moderate	Minor	Options ST2A, ST2B and ST2D: Little change in view from this location due to screening from landform and intervening vegetation. Option ST2C: Loss of AWI woodland to the north of the viewpoint due to the introduction of realigned unclassified road to Inver and the northbound merge slip road, and SuDS would result in limited visibility to the new River Braan crossing and traffic on the A9.
	Significance	Negligible	Negligible	**Moderate**	Negligible	
13: Inver Bridge and Core Path	*Sensitivity: High Magnitude:*	Minor	Minor	Moderate	Minor	Options ST2A, ST2B and ST2D: Slight increase in visibility of vehicles on the A9 due to loss of roadside vegetation and the widened mainline being on slight embankment. Option ST2C: Increased visibility of vehicles on the A9 due to the raised vertical alignment of the widened mainline on embankment and resultant loss of woodland.
	Significance	Slight	Slight	**Moderate**	Slight	
14: A822 (Old Military Road), approaching Little Dunkeld	*Sensitivity: Moderate Magnitude:*	Moderate	Moderate	Minor	Minor	Options ST2A and ST2B: Introduction of new access road to properties along Birnam Glen, south of the existing A9, cuttings and associated loss of woodland would impact views. Option ST2C: Loss of mature trees due to introduction of Dunkeld Junction to north of the railway. Option ST2D: Negligible change in views.
	Significance	**Moderate**	**Moderate**	Slight	Slight	
15: Core Path, northern edge of Inver	*Sensitivity: High Magnitude:*	Moderate	Moderate	Moderate	Moderate	All proposed route options: Widening of A9 and associated earthworks would lead to loss of woodland along the southbound (opposite) carriageway and would increase traffic and give more open views. Realignment of A9 would slightly increase separation distance from Inver properties.
	Significance	**Moderate**	**Moderate**	**Moderate**	**Moderate**	

Representative Viewpoint	Assessment	Option ST2A	Option ST2B	Option ST2C	Option ST2D	Description of Potential Impact/Effect and the Elements Visible
16: Car park at The Hermitage Garden and Designed Landscape	*Sensitivity: High Magnitude:*	Minor	Minor	Minor	Minor	All proposed route options: The realignment and widening of the A9 mainline and car park access would introduce associated earthworks and result in the loss of woodland along the southbound carriageway and at the entrance to the car park. Views would be opened up to the north towards the river following the removal of the vegetation whilst the realignment of the A9 would increase the separation distance from the A9 traffic.
	Significance	**Moderate**	**Moderate**	**Moderate**	**Moderate**	
17: Core Path south of Dunkeld House Hotel Garden and Designed Landscape/ NCR 77	*Sensitivity: High Magnitude:*	Moderate	Moderate	Moderate	Moderate	All proposed route options: Views to the existing A9 are currently screened by intervening vegetation but due to the loss of woodland adjacent to the southbound carriageway at ch5100 to ch5450, filtered views may be obtained of the new embankment and to traffic on the realigned A9.
	Significance	**Moderate**	**Moderate**	**Moderate**	**Moderate**	
18: Pine Cone Viewpoint	*Sensitivity: High Magnitude:*	Minor	Minor	Minor	Minor	All proposed route options: Looking north, the realigned and widened A9, northern section of the B898 link road, the new Tay Crossing and proposed SuDS to the east of the A9 would be visible along with their associated earthworks, from approximately ch7000 to the end of the proposed route options. There would also be a loss of existing roadside woodland which was previously visible from this location, but there would be little change to the overall panoramic views. Views to the A9 to the south would be filtered by trees.
	Significance	Slight	Slight	Slight	Slight	
19: Core Path and NCR 77, south of Tay Crossing	*Sensitivity: High Magnitude:*	Minor	Minor	Minor	Minor	All proposed route options: View of new River Tay crossing structure and embankment at northern end of bridge with a loss of broadleaved trees on the river bank close to the bridge and a limited separation distance.
	Significance	Slight	Slight	Slight	Slight	
20: Core Path and NCR 77, north of Tay Crossing	*Sensitivity: High Magnitude:*	Moderate	Moderate	Moderate	Moderate	All proposed route options: View of the widened River Tay crossing structure and embankment would replace the view of the existing River Tay crossing and embankment, with an associated loss of roadside vegetation.
	Significance	**Moderate**	**Moderate**	**Moderate**	**Moderate**	
21: B898/NCR 77, Inchmagrannachan	*Sensitivity: High Magnitude:*	Moderate	Moderate	Moderate	Moderate	All proposed route options: Loss of woodland on lower hill slopes on opposite side of strath due to widening of mainline would result in visibility of new cuttings.
	Significance	**Moderate**	**Moderate**	**Moderate**	**Moderate**	

Impacts and Effects Common to All Proposed Route Options

13.4.13 Between the start of the project at the Pass of Birnam (ch0) and Dalpowie Plantation (approx. ch400), and between Inver (approx. ch4800) and the end of the project (ch8350), the proposed route options are similar. As such, the potential for visual impacts on the representative viewpoints close to these locations (viewpoints 15, 16, 17, 18, 19, 20 and 21) would be common to all proposed route options. Long distance views to the proposed route options would also be affected by similar potential impacts for all the route options as the longer separation distances from the proposed route options lead to a more generalised impact resulting from any woodland loss and a lessening of specific individual potential impacts (viewpoints 3, 5, 9, 18 and 21).

Impacts and Effects Specific to Option ST2A

13.4.14 The following section summarises the potential impacts and effects specific to Option ST2A or are common to Option ST2A and at least one of the other proposed route options, but not all. The main elements of Option ST2A visible by receptors include the proposed widened mainline (and associated traffic), the grade separated Murthly Junction, the cut and cover tunnel, the replacement car park at Dunkeld & Birnam Station, Dunkeld Junction roundabout, new bridge structures crossing the Rivers Braan and Tay, all associated earthworks and the loss of woodland.

13.4.15 In addition to the potential impacts common to all proposed route options, the potential for the following impacts and resulting effects, are identified for Option ST2A:

- From viewpoint 1 at the West Entrance to Murthly Castle GDL there would be the potential for Large effects to be experienced by visitors to the estate. The potential for these significant effects would result from close range views of the widened A9 in addition to views of the proposed grade separated Murthly Junction and overbridge with associated earthworks. Furthermore, the potential effects would arise from the loss of existing woodland which appreciably influences the extent of views at this location.
- From viewpoint 2 at the A9 Lay-by near Ringwood there would be the potential for Large effects to be experienced by road users. These potentially significant effects would result from the realignment of the widened A9 and associated cuttings, resulting in the loss of a notable number of mature roadside AWI trees and the introduction of the Murthly Junction with overbridge to the south and the tunnel entrance to the north.
- From viewpoint 4 at the junction of the B867/NCR 77 there would be the potential for Moderate effects to be experienced by road users and cyclists. The potential for these significant effects would arise from an increase in the prominence of road infrastructure in views resulting from the road widening, visibility of the realigned B867 and associated earthworks, in addition to changes in visual amenity resulting from the loss of AWI woodland and the introduction of the proposed tunnel control building on top of the tunnel.
- From viewpoint 6 at the junction of Perth Road and Station Road in Birnam, there would be the potential for Moderate effects to be experienced by residents, road users and walkers. There would be a reduction in the visibility of vehicles on the A9. However, the potential for significant effects would result from a loss of trees at the southern end of Station Road and views to both the existing station building and the replacement station car park (as per Option ST2B).
- From viewpoint 7 at the footbridge at Dunkeld & Birnam Station, there would be the potential for Moderate effects to be experienced by rail users. The potential for significant effects would result from the lowering of the A9 and creation of the replacement station car park located on top. The proposed tunnel would however result in traffic associated with the lowered and widened A9 being concealed from view.

- From viewpoint 8 there would be reduced visibility of vehicles on A9 from the rear side aspect of properties, as A9 would be in tunnel/cutting. The introduction of new cuttings associated with the widened mainline and the resultant loss of existing roadside woodland at the northern entrance to the tunnel would result in the potential for significant (Moderate) visual effects from properties further west on Telford Gardens than viewpoint 8, and from properties at King Duncan's Place.
- From viewpoint 10 at Dunkeld Cathedral and Grounds, there would be the potential for Moderate effects to be experienced by visitors to the Cathedral gardens. The potential for these significant effects would result from the elevated A9 to the west of the River Braan, with views of the embankment together with increased visibility of traffic on the A9.
- From viewpoint 11 at the Birnam Highland Games Park, there would be the potential for Moderate effects to be experienced by visitors. The potential for these significant effects would arise from the introduction of the new River Braan crossing and roundabout at Dunkeld Junction, and the resultant loss of mature roadside vegetation and increased visibility of traffic on the A9.
- From viewpoint 14 on the A822 (Old Military Road) approaching Little Dunkeld, there would be the potential for Moderate effects to be experienced by road users. The potential for these significant effects would arise from the introduction of the new access road in the vicinity of Braeknowe, associated cuttings and the resultant loss of woodland.

13.4.16 The lowering of Inchewan Burn would have the potential to result in Large significant visual effects along the watercourse between the A9 and Perth Road for walkers along Core Path DUNK/11 and residents of Birnam Glen (in the vicinity of viewpoint 6). These potential effects would result from the loss of existing vegetation and the introduction of a box culvert and retaining walls up to approximately 5m high.

Impacts and Effects Specific to Option ST2B

13.4.17 The following section summarises the potential impacts and effects specific to Option ST2B or those that are common to Option ST2B and at least one of the other proposed route options, but not all. The main elements of Option ST2B visible by receptors would include the proposed widened mainline (and associated traffic), the grade separated Birnam Junction, the replacement car park at Dunkeld & Birnam Station, retaining walls associated with the proposed underpass, the Dunkeld Junction roundabout, new bridge structures crossing the rivers Braan and Tay, all associated earthworks and the resultant loss of woodland.

13.4.18 In addition to potential impacts common to all proposed route options, the potential for the following impacts and resulting significant effects are identified for Option ST2B:

- From viewpoint 1 at the West Entrance to Murthly Castle, there would be the potential for Moderate effects to be experienced by visitors to the Murthly Castle GDL. The potential for these significant effects would result from close range views of the widened A9 in addition to views of the proposed Murthly access road underbridge, SuDS and associated earthworks. Furthermore, the effects would arise from the loss of existing woodland which appreciably influences the extent of views at this location.
- From viewpoint 2 at the A9 Lay-by near Ringwood there would be the potential for Moderate effects to be experienced by road users. The potential for these significant effects would result from the realignment of the widened A9 and associated cuttings resulting in the loss of a notable number of mature roadside AWI trees, and visibility of the proposed Birnam Junction and associated earthworks to the north.
- From viewpoint 4 at the junction of the B867/NCR 77, there would be the potential for Large effects to be experienced by road users and cyclists. The potential for these significant effects would arise from the loss of mature AWI woodland in addition to close range visibility to the new B867 underbridge and grade separated junctions with associated large-scale earthworks.

- From viewpoint 5 at the south-west of Newtyle Hill, there would be the potential for Moderate effects to be experienced by walkers. The potential for these significant effects would result from increased visibility to the widened A9, side roads and SuDS, particularly at Birnam Junction, where there would be a noticeable loss of screening AWI woodland.
- From viewpoint 6 at the junction of Perth Road and Station Road in Birnam, there would be the potential for Moderate effects to be experienced by residents, road users and walkers (as per Option ST2A).
- From viewpoint 7 at the footbridge at Dunkeld & Birnam Station, there would be the potential for Moderate effects to be experienced by rail users. The potential for these significant effects would result from the lowering of the A9 and creation of the replacement station car park located on top of the proposed underpass. The widened mainline and associated southbound retaining wall and traffic would be visible to the south-east of the proposed underpass.
- From viewpoint 8 at Telford Gardens, Little Dunkeld, there would be the potential for Moderate effects to be experienced by the residents of the properties along this road. The potential for these significant effects would result primarily from the loss of roadside vegetation directly adjacent to the housing, leading to an increase in visibility of the widened A9 and associated earthworks.
- From viewpoint 10 at Dunkeld Cathedral and Grounds, there would be the potential for Moderate effects to be experienced by visitors (as per Option ST2A).
- From viewpoint 11 at the Birnam Highland Games Park, there would be the potential for Moderate effects to be experienced by visitors (as per Option ST2A).
- From viewpoint 14 on the A822 (Old Military Road) approaching Little Dunkeld, there would be the potential for Moderate effects to be experienced by road users (as per Option ST2A).

13.4.19 The lowering of Inchewan Burn would result in the potential for Large significant visual effects along the watercourse between the A9 and Perth Road for walkers along Core Path DUNK/11 and residents of Birnam Glen (in the vicinity of viewpoint 6). These effects would result from the loss of existing vegetation and the introduction of a box culvert and retaining walls up to approximately 2m high.

Impacts and Effects Specific to Option ST2C

13.4.20 The following section summarises the potential impacts and effects specific to Option ST2C or those that are common to Option ST2C and at least one of the other proposed route options, but not all. The main elements of Option ST2C visible by receptors include the proposed widened mainline (and associated traffic), the grade separated Birnam Junction, the relocated Dunkeld & Birnam Station and associated access road, the grade separated Dunkeld Junction, new bridge structures crossing the Rivers Braan and Tay, all associated earthworks and the resultant loss of woodland.

13.4.21 In addition to potential impacts common to all proposed route options, the potential for the following significant effects are identified for Option ST2C:

- From viewpoint 1 at the West Entrance to Murthly Castle, there would be the potential for Moderate effects to be experienced by visitors to the Murthly Castle GDL as per Option ST2B.
- From viewpoint 2 at the A9 Lay-by near Ringwood there would be the potential for Moderate effects to be experienced by road users as per Option ST2B.
- From viewpoint 4 at the junction of the B867/NCR 77, there would be the potential for Large effects to be experienced by road users and cyclists as per Option ST2B.
- From viewpoint 5 at the South-west of Newtyle Hill, there would be the potential for Moderate effects to be experienced by walkers as per Option ST2B.

- From Viewpoint 6 at the junction of Perth Road and Station Road there would be potential for Moderate effects to be experienced by residents. The potential for these significant effects would be due to visibility of the Station car park and a loss of trees at the southern end of Station Road resulting in increased visibility to the traffic on the A9.
- From viewpoint 7 at the footbridge at Dunkeld & Birnam Station, there would be the potential for Large effects to be experienced by rail users. The potential for these significant effects would arise from the loss of mature AWI trees, direct visibility of the widened A9 from this elevated viewpoint, the close proximity of the road and the lack of intervening vegetation.
- From viewpoint 8 at Telford Gardens, Little Dunkeld, there would be the potential for Large effects to be experienced by residents. The potential for these significant effects would arise from the introduction of the grade separated Dunkeld Junction and raising of the mainline leading to a loss of woodland currently screening the existing A9, resulting in visibility of the elevated A9, slip roads and associated traffic. It should be noted that other residents within the area would be likely to potentially experience similar significant visual effects together with visibility of proposed noise barriers and SuDS from rear aspects of properties at Telford Gardens, King Duncan's Place, Stell Park Road and from Braeknowe. Furthermore, the removal of the existing screening bund and mixed woodland between the A9 and the Highland Main Line railway would open up views to the proposed relocated Dunkeld & Birnam Station.
- From viewpoint 10 at Dunkeld Cathedral and Grounds, there would be the potential for Large effects to be experienced by visitors to the Cathedral gardens. The potential for these significant effects would result from the elevated A9 to the west of the River Braan, with views of the large-scale embankment together with increased visibility of traffic on the A9.
- From viewpoint 11 at the Birnam Highland Games Park, there would be the potential for Large effects to be experienced by visitors. The potential for these significant effects would arise from the introduction of the new River Braan crossing, slip roads, the raised vertical alignment of the widened mainline and the resultant loss of mature roadside vegetation and increased visibility of all associated traffic.
- From viewpoint 13 at Inver Bridge there would be the potential for Moderate effects to be experienced by road users and walkers. The potential for these significant effects would arise from the introduction of the new River Braan crossing with its associated earthworks and the resultant loss of intervening vegetation and increased visibility of associated traffic.

Impacts and Effects Specific to Option ST2D

13.4.22 The following section summarises the potential impacts and effects specific to Option ST2D or those that are common to Option ST2D and at least one of the other propose route options, but not all. The main elements of Option ST2D visible by receptors include the proposed widened mainline (and associated traffic), the grade separated Birnam Junction, the replacement car park at Dunkeld & Birnam Station, the Dunkeld Junction roundabout, new bridge structures crossing the Rivers Braan and Tay, all associated earthworks and the resultant loss of woodland.

13.4.23 In addition to potential impacts common to all proposed route options, the potential for the following significant effects are identified for Option ST2D:

- From viewpoint 1 at the West Entrance to Murthly Castle, there would be the potential for Moderate effects to be experienced by visitors to the Murthly Castle GDL (as per Option ST2B).
- From viewpoint 2 at the A9 Lay-by near Ringwood there would be the potential for Moderate effects to be experienced by road users (as per Option ST2B).
- From viewpoint 4 at the junction of the B867/NCR 77, there would be the potential for Large effects to be experienced by road users and cyclists (as per Option ST2B).

- From viewpoint 5 at the South-west of Newtyle Hill, there would be the potential for Moderate effects to be experienced by walkers (as per Option ST2B).
- From viewpoint 6 at the junction of Perth Road and Station Road in Birnam, there would be the potential for Moderate effects to be experienced by residents, road users and walkers. The potential for significant effects would arise due to partial visibility of the replacement car park at the southern end of Station Road and a partial loss of trees at the southern end of Station Road potentially leading to increased visibility of A9 traffic.
- From viewpoint 7 at the footbridge at Dunkeld & Birnam Station, there would be the potential for Large effects to be experienced by rail users. These potential significant effects would arise due to the proximity of the widened A9 from this elevated viewpoint, the loss of intervening vegetation which currently filters views of the existing A9 from the viewpoint, the removal of roadside vegetation adjacent to the southbound carriageway and visibility of the replacement station car park.
- From viewpoint 10 at Dunkeld Cathedral and Grounds, there would be the potential for Moderate effects to be experienced by visitors (as per Option ST2A).
- From viewpoint 11 at the Birnam Highland Games Park there would be the potential for Moderate effects to be experienced by visitors (as per Option ST2A).

13.5 Potential Mitigation

13.5.1 Anticipated potential mitigation measures for both construction and operation phases are described in Volume 1, Part 3 – Environmental Assessment (Chapter 12: Landscape), Section 12.5 (Potential Mitigation) and indicative conceptual landscape mitigation plans are provided on Figures 12.4 to 12.7 of Volume 1, Part 3 – Environmental Assessment (Chapter 12: Landscape) and are not replicated here. A more detailed mitigation design would be developed during DMRB Stage 3. The plans include indicative measures which would mitigate effects on the views that vehicle travellers would experience from each of the proposed route options.

13.6 Summary of Route Options Assessment

13.6.1 This section provides a summary of the assessment of potential effects on visual amenity for the four proposed route options taking into account the 'embedded' mitigation measures incorporated in the designs of the proposed route options (e.g. alignment, design elements, grading out of earthworks), and the potential mitigation measures, including the conceptual indicative landscape mitigation proposals, described in Section 12.5 (Potential Mitigation) of Volume 1, Part 3 – Environmental Assessment (Chapter 12: Landscape).

13.6.2 Professional judgement has been used to consider the likely mitigating effects of more detailed landscape mitigation, which would be developed as part of DMRB Stage 3 for the Preferred Route Option and would include measures such as replacement woodland planting to screen views and enhance landscape integration. As this level of mitigation detail is not available at DMRB Stage 2, the residual effects in this summary section are necessarily precautionary (i.e. it may be possible to further reduce stated effects as part of the detailed design and assessment of the Preferred Route Option).

13.6.3 For the comparison of proposed route options, two aspects are considered; whether the potential for any residual effects would be considered significant in the context of the EIA Regulations, and whether the potential for impacts and effects differ sufficiently between proposed route options such that they can be considered a differentiator and need to be considered as part of the overall identification of the Preferred Route Option which, as explained in Volume 1, Part 3 – Environmental Assessment (Chapter 7: Overview of Environmental Assessment), takes into account environmental, engineering, economic and traffic considerations.

13.6.4 The potential impact assessment is provided in Section 13.3 (Table 13.10 and *Appendix A13.1: Visual Assessment Tables*) in addition to *Appendix A13.2: View from the Road* for vehicle travellers.

13.6.5 In summary, the potential for significant effects on visual amenity, in the context of the EIA Regulations, are predicted for all of the proposed route options between Dalpowie Plantation and Inver (approx. ch400-ch4800) with the potential for significant effects ranging between Moderate to Large (depending on the proposed route option) at eleven receptor locations (Viewpoints 1, 2, 4, 5, 6, 7, 8, 10, 11, 13 and 14). From ch4800 to the end of the proposed route options a further five viewpoints (viewpoints 15, 16, 17, 20 and 21) would have the potential for significant effects resulting from changes which would be common to all proposed route options.

13.6.6 The majority of these visual effects would result from the increased visibility of the road (and associated traffic) as a result of the loss of existing screening vegetation, the closer proximity of the road to the receptors as a result of the widening of the road, the introduction of new large-scale earthworks and structures and views of traffic elevated on embankment. Differentiation between the proposed route options would be apparent from receptor locations on the southern edges of Birnam and at Little Dunkeld largely due to the increased visibility of the proposed route options resulting from the loss of existing screening vegetation, carriageway widening, the introduction of earthworks, retaining walls and slip roads and the varied carriageway levels.

13.6.7 Differentiation between the proposed route options also arises as a result of the realignment of the dualled A9 to below surface level with the cut and cover tunnel (Option ST2A) and the underpass (Option ST2B). Both the tunnel and the underpass would reduce and/or remove traffic from view over a section of the route however, both would be likely to result in the removal of roadside trees in the vicinity of Little Dunkeld (at King Duncan's Place and Telford Gardens) which would lead to potential effects on visual amenity. Retention of the existing roadside planting alongside the southbound carriageway where it passes Little Dunkeld and Birnam would result in views from adjacent properties remaining relatively unchanged with Option ST2D.

13.6.8 Option ST2C is predicted to result in the potential for the greatest overall visual effect of all the proposed route options as a result of the raised vertical alignment and the grade separated Dunkeld Junction. Both of these elements would be likely to increase the prominence of road infrastructure (and traffic) in views from surrounding visual receptors as reflected in four of the viewpoints being assessed as Large (viewpoints 4, 7, 8 and 11). The potential for these visual effects differentiates Option ST2C from the other proposed route options.

13.6.9 The changes to the existing junction with the B867 south of Birnam with Option ST2A would have the potential for a lesser visual effect at viewpoint 4 (B867/NCR 77) than the other three proposed route options, although Option ST2A would have the potential for a greater visual effect on viewpoint 1 (West Entrance to Murthly Castle Garden & Designed Landscape) with the introduction of the grade separated junction into the rural landscape at Dalpowie. At Dunkeld & Birnam Station (viewpoint 7), Option ST2A and Option ST2B would remove A9 traffic from surface level, however both options would introduce replacement car parking for Dunkeld & Birnam Station and there would be the potential for significant visual effects during construction, with estimated construction phases of 4.5 to 5 years for Option ST2A and 4 to 4.5 years for Option ST2B.

13.6.10 For five of the viewpoint locations (viewpoints 3, 9, 12, 18 and 19), the proposed route options would be unlikely to result in the potential for significant effects on the visual amenity of built and outdoor receptors. This is a consequence of the retention (or minor modification only) of intervening landform and/or woodland which currently screen views of the existing A9 and which would also screen views of the proposed route options.

13.6.11 Where potential effects do arise, the majority of predicted potential effects associated with each of the proposed route options could potentially be reduced. The reductions in potential effects would principally be derived from the implementation and establishment of areas of woodland planting indicated within the conceptual landscape mitigation proposals provided on Figures 12.4 to 12.7 and described in Volume 1, Part 3 – Environmental Assessment (Chapter 12: Landscape), Section 12.5 (Potential Mitigation). Primarily, establishment of the planting proposals would help to screen the proposed route options from view in combination with the other mitigation measures.

13.6.12 For Option ST2A, further mitigation would be achieved by implementation of landscape planting on top of the cut and cover tunnel. It has been assumed that the design of the tunnel would not allow for the planting of large trees, the roots of which would adversely affect the structure, so planting would be limited to smaller trees and shrubs. However, there would be scope for further mitigation if root barriers were to be included within the tunnel design. Once established, the proposed 'meadow' areas and planting of smaller trees and shrubs would be likely to reduce potential effects on visual amenity, particularly at properties at Telford Gardens, Stell Park Road and in the south of Birnam. Mitigation planting above the Option ST2B underpass would be limited to formal planting in raised planters and Option ST2A would have the potential for lesser effects on visual amenity than Option ST2B.

13.6.13 A summary assessment of how the mitigation measures would influence the potential for visual effects associated with each of the proposed route options in summer 15 years after completion is provided in Table 13.8 for viewpoint locations where the potential for significant effects are predicted to occur. For all other viewpoints it is anticipated that the mitigation measures would reduce the potential for visual effects to such a degree that they would not be significant. These reductions would largely be attributable to the establishment of the mitigation planting which would help to screen views and integrate the proposed route options into the landscape. Indicative conceptual proposals for this planting are provided on Figures 12.4 to 12.7. It should be noted that, in undertaking this assessment, professional judgement has been used to consider the likely effectiveness of the mitigation measures. As the mitigation proposals are conceptual, and the associated level of detail limited, the potential for predicted residual effects in this summary section are necessarily precautionary.

13.6.14 The potential for differences in effects between proposed route options are considered sufficient to differentiate between them and a comparative assessment is provided in Table 13.10.

13.6.15 The DMRB Stage 2 assessment of View from the Road has identified a number of potential impacts and effects associated with the route options, as described in *Appendix A13.2: View from the Road* and summarised in Table 13.9 below. Taking into account the potential for significant effects, a comparative assessment is provided in Table 13.11.

Table 13.8: Summary of Assessment – Visual

Chapter/Subcategory			Predicted Residual Effect				Comments
			Option ST2A	Option ST2B	Option ST2C	Option ST2D	
Visual	Construction	All sub-categories	The construction phase has an estimated duration of 4.5 to 5 years. Highest overall effects due to large scale and prolonged construction operations required to construct the cut and cover tunnel. Additional effects from construction of Murthly Junction.	The construction phase has an estimated duration of 4 to 4.5 years. Highest overall effects with exception of Option ST2A during construction due to the large-scale operations required to construct the 150m underpass. Additional effects from construction of grade separated Birnam Junction.	The construction phase has an estimated duration of 2.5 to 3 years. Intermediate overall effects during construction due to the construction of the junctions entailing soil nailing, retaining walls and large-scale earthworks. Additional effects from construction of grade separated Birnam Junction.	The construction phase has an estimated duration of 2.5 to 3 years. Lowest overall effects during construction due to the realigned route being mostly online. Additional effects from construction of grade separated Birnam Junction.	Assumes that best practice measures would be implemented for all proposed route options to mitigate construction phase visual effects (refer to Chapter 12: Landscape, Section 12.5 (Potential Mitigation)).
	Operation	1: West Entrance to Murthly Castle GDL	**Moderate**	Slight	Slight	Slight	Significant effects for Option ST2A due to introduction of a grade separated junction and overbridge with limited scope for the reduction in effects in consideration of the potential mitigation measures.
		4: B867/NCR 77	Slight	**Moderate**	**Moderate**	**Moderate**	Significant effects for Options ST2B, ST2C and ST2D due to introduction of grade separated Birnam Junction. Proposed woodland mitigation planting at the junction, including replacement planting for the existing area of felled AWI woodland at Ringwood would have the potential to reduce effects.
		7: Footbridge at Dunkeld & Birnam Station	**Moderate**	**Moderate**	**Large**	**Large**	Significant effects for all proposed route options due to close proximity of widened A9 and/or introduction of the replacement car parking facilities. The proposed mitigation planting on top of the Option ST2A cut and cover tunnel (and

Chapter/Subcategory			Predicted Residual Effect				Comments
			Option ST2A	Option ST2B	Option ST2C	Option ST2D	
Visual	Operation						formal planting in raised planters on top of the Option ST2B underpass) would have the potential to reduce effects and potentially benefit visual amenity.
		8: Telford Gardens, Little Dunkeld	Slight	**Moderate**	**Large**	Negligible	Significant effects for Options ST2B and ST2C due to loss of existing screening. While this would be replaced as part of the mitigation proposals for ST2B, effects associated with Option ST2C would remain Large due to the higher vertical alignment reducing opportunities to mitigate potential effects. The proposed mitigation planting above the Option ST2A cut and cover tunnel would have the potential to reduce effects and potentially benefit visual amenity. Option ST2D would have the least effect as there would be lesser change to the existing view.
		10: Dunkeld Cathedral and Grounds	Slight	Slight	**Moderate**	Slight	Significant effects for Option ST2C due to increased visibility of A9 and embankment. While mitigation planting would help to integrate the road into the landscape it is predicted that some visibility would be likely to remain.
		11: Birnam Highland Games Park	**Moderate**	**Moderate**	**Large**	**Moderate**	Significant effects for all proposed route options due to increased visibility of A9 and loss of woodland. Although woodland would be replaced to some degree and mature to screen views, it is envisaged that visibility to all of the proposed route options would remain. Visibility to large scale retaining wall on southern boundary of park for Option ST2C.

Chapter/Subcategory	Predicted Residual Effect				Comments
	Option ST2A	Option ST2B	Option ST2C	Option ST2D	
14: A822 (Old Military Road) approaching Little Dunkeld	**Moderate**	**Moderate**	Negligible	Negligible	Significant effects for Options ST2A and ST2B due to introduction of new access road for Options ST2A and ST2B and associated loss of woodland. While mitigation planting would help to integrate these options into the landscape and screen views, it is predicted that some visibility of the options would remain.

Table 13.9: Summary of Assessment – Vehicle Travellers (View from the Road)

Chapter/Subcategory			Predicted Residual Effect				Comments
			Option ST2A	Option ST2B	Option ST2C	Option ST2D	
View from the Road	Operation	View from the Road – Dalpowie Plantation (approx. ch850) to Birnam Junction (approx. ch2200)	Moderate	Slight	Slight	Slight	Views from the road would be affected by the proposed Murthly junction and change in the nature of the available view as the road descends the Pass of Birnam. Prior to entry to the tunnel, views from Option ST2A would be comparable to the existing situation, the proposed route option being slightly more open than at present. Options ST2B, Option ST2C, and Option ST2D would have comparable effects on the view from the road, impacts primarily arising from the loss of woodland and increased prominence of road infrastructure at Birnam Junction. Option ST2A would result in a Moderate effect on the view from the road which differentiates this option from Option ST2B, Option ST2C and Option ST2D
		View from the Road – Birnam Junction (approx. ch2200) to Inver (approx. ch4900)	**Large**	**Moderate**	**Moderate**	Slight	Option ST2A is considered to have the highest effect, as this proposed route option features a tunnel structure which would curtail all views of the surrounding landscape (resulting in the highest effect of all the options on northbound travellers' experience of the 'Gateway to the Highlands' Special Quality). The section of underpass associated with Option ST2B would also result in the curtailment of views and affect the 'Gateway' experience, albeit not to the same extent as Option ST2A. The increased elevation of Option ST2C (and junction arrangement at Little Dunkeld) would result in less enclosure of the road by woodland and views of a more open nature, but also views of the Dunkeld Junction and associated structures. Option ST2D is considered to have the lowest effect as this proposed route option would result in the least change to the existing baseline situation with potentially greater opportunities for mitigation and/or enhancement in respect of the 'Gateway' experience.
		View from the Road – Inver (approx. ch4900) to ch8280	Slight	Slight	Slight	Slight	Significance of effects are assessed to be the same for each proposed route option, therefore the predicted residual effects are not considered sufficient to differentiate between the proposed route options.

Compliance Against Plans and Policies

13.6.16 DMRB LA 104 states that environmental assessment, reporting and monitoring shall meet the requirements of the national planning policy for each relevant Overseeing Organisation.

13.6.17 *Appendix A21.1 (Assessment of Policy Compliance)* provides a review of national, regional and local policy documents which are of relevance to this assessment undertaken and reported in this chapter in accordance with DMRB guidance.

13.6.18 National Planning Policy objectives (and accompanying best practice guidance) of relevance to this assessment are provided in National Planning Framework 3 (Scottish Government, 2014a), Scottish Planning Policy (SPP) (Scottish Government, 2014b; Revised 2020) themes *Placemaking*, *Valuing the Natural Environment* and *Valuing the Historic Environment*, Scotland's Third Land Use Strategy 2021-2026 (Scottish Government, 2020) and Fitting Landscapes (Transport Scotland, 2014a). In addition, local policies of relevance include Perth and Kinross Local Development Plan 2 (PKC LDP2) (PKC, 2019) Policies 1 (Placemaking), 39 (Landscape) and TAYplan Policies 2 (Shaping Better Quality Places) and 9 (Managing TAYplan's Assets) (TAYplan, 2017).

13.6.19 A full policy compliance assessment can be found in Table 5 of *Appendix A21.1 (Assessment of Policy Compliance)* which combines the assessments of Volume 1, Part 3 – Environmental Assessment (Chapter 12: Landscape and Chapter 13: Visual) due to the similarity in policy of relevance to both assessments. It is assessed that although significant effects are anticipated related to landscape quality and viewpoint locations, implementation of mitigation measures is anticipated to reduce impacts on receptors in most cases. Upon confirmation of specific mitigation proposals at DMRB Stage 3, full policy compliance assessment can be undertaken.

Community Objectives

13.6.20 The community objectives (refer to Volume 1, Part 3 – Environmental Assessment (Chapter 7: Overview of Environmental Assessment, Table 7.2)) have been considered throughout DMRB Stage 2. *Appendix A7.1: Mapping of Community Objectives Against DMRB Stage 2 Route Options* sets out which DMRB Stage 2 environmental topics are relevant to each of the community objectives.

13.6.21 *Appendix A7.1: Mapping of Community Objectives Against DMRB Stage 2 Route Options* confirms that community objectives 2 and 5 are relevant to the assessment of potential visual impacts. Professional judgement has been used to consider how the proposed route options contribute to these objectives for the operation phase, as summarised in Table 13.10.

13.6.22 The contribution of the operation phase of each of the proposed route options to the relevant community objectives was categorised according to the following key.

Contributes to all/most of the community objective	
Contributes to part of the community objective	
Contributes to little/none of the community objective	

Table 13.10: Contribution to Community Objectives During Operation for this Environmental Topic

Relevant Community Objective		Option ST2A	Option ST2B	Option ST2C	Option ST2D
2	Protect and enhance the scenic beauty and natural heritage of the area and its distinctive character and quality.				
5	Examine and identify opportunities to enhance the levels of cycling and walking for transport and leisure, including the improvement of existing footpaths and cycle ways, to promote positive mental health and well-being.				

13.6.23 Option ST2A is considered to contribute in part to community objective 5, due to the potential for landscaping the covered tunnel with amenity space in addition to improvements to the footpath and cycle networks. However, there would be potential adverse effects along other stretches of the route. All other proposed route options are considered to contribute little/none to community objectives 2 and 5 in terms of visual. Potential effects during construction would be broadly similar for all proposed route options and are also not considered to contribute to the community objectives. However, mitigation would be developed at DMRB Stage 3 with the aim to reduce the significant potential effects of the Preferred Route Option.

Comparative Assessment

Visual

13.6.24 Consideration of the potential for differences in effects on visual amenity associated with each of the proposed route options allows for a comparative assessment as provided in Table 13.10. This comparative assessment has taken into account the potential overall effects of each of the proposed route options on visual amenity with consideration of the potential mitigation measures. It also includes consideration of locations where there would be potential benefits to visual amenity (namely benefits associated with Option ST2A as a result of the cut and cover tunnel in combination with landscape mitigation).

Table 13.10: Comparative Assessment – Visual

Route Option	Lowest Overall Effect	Intermediate Overall Effect	Highest Overall Effect
Option ST2A	✓		
Option ST2B		✓	
Option ST2C			✓
Option ST2D	✓		

View from the Road

13.6.25 Consideration of the potential for differences in effects on the View from the Road associated with each of the proposed route options allows for a comparative assessment as provided in Table 13.11. As described in *Appendix A13.2 (View from the Road)*, Option ST2A is considered to have the greatest overall effect as a result of the tunnelled section (and curtailment of all views of the surrounding landscape) in addition to highest overall effect on the 'Gateway to the Highlands' Special Quality of the River Tay (Dunkeld) NSA. Option ST2D is considered to have the lowest overall effect due to this option resulting in the least change to the existing baseline situation and greater opportunities for mitigation and/or enhancement.

Table 13.11: Comparative Assessment – View from the Road

Route Option	Lowest Overall Effect	Intermediate Overall Effect	Highest Overall Effect
Option ST2A			✓
Option ST2B		✓	
Option ST2C		✓	
Option ST2D	✓		

13.7 Scope of DMRB Stage 3 Assessment

13.7.1 It is proposed that the DMRB Stage 3 assessment for Visual would be undertaken in accordance with GLVIA3 and cognisant of DMRB LA 107. It should be noted that the Scotland National Application Annex for DMRB LA 107 is not yet published. It is the intention adopt the updated guidance during the DMRB Stage 3 assessment and this would be clearly stated in the relevant assessment chapters presented in the EIA Report.

13.7.2 The DMRB Stage 3 assessment is anticipated to include the following:

- Updated baseline landscape assessment including site visits, as necessary.
- Detailed visual assessment to identify the receptors likely to experience changes to their visual amenity and identify the mitigation measures necessary to reduce potential effects. Key areas of focus in the assessment would include the potential effects associated with the Birnam/Murthly Junctions and Dunkeld Junction, and the changes to visibility of the road as a result of the loss of existing screening vegetation around receptors and along the road corridor.
- Development of mitigation proposals in accordance with DMRB LD 117 'Landscape Design' (Highways England et al., 2020) and Transport Scotland's policy document: Fitting Landscapes: Securing more sustainable landscapes, published in March 2014.

13.7.3 In addition, photomontages would be prepared to represent key views at locations to be determined in consultation with NatureScot and PKC.

13.8 References

Reports and Documents

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Transport Scotland (2014a). Fitting Landscapes: Securing more sustainable landscapes.

Transport Scotland (2014b). A9 Dualling Programme: Strategic Environmental Assessment (SEA) Environmental Report Addendum. Appendix F – Strategic Landscape Review Report. Transport Scotland. March 2014.

Transport Scotland (2014c). A9 Dualling Programme: Strategic Environmental Assessment (SEA) Post Adoption Statement.

14. Cultural Heritage

14.1 Introduction

14.1.1 This chapter presents the results of the cultural heritage assessment for the Design Manual for Roads and Bridges (DMRB) Stage 2 environmental assessment of the proposed route options.

14.1.2 The assessment was undertaken based on the guidance provided in DMRB LA 104 'Environmental assessment and monitoring' Revision 1 (Highways England et al, 2020a; hereafter DMRB LA 104) and DMRB LA 106 'Cultural heritage assessment' Revision 1 (Highways England et al, 2020b; hereafter DMRB LA 106).

14.1.3 Cultural heritage resources are synonymous with historic assets and heritage assets which Historic Environment Policy for Scotland (HEPS) define as '*a building, monument, site, place, area or landscape identified as having cultural significance*' (Historic Environment Scotland, 2019a; page 4)

14.1.4 To facilitate assessment the cultural heritage resource has been considered under the following sub-topics:

- Archaeological remains - are monuments with '*elements or structures of an archaeological nature*' and sites containing '*material remains resulting from the works of humans or the combined works of nature and humans, and areas including archaeological sites*' Note 1 and Note 3 of DMRB LA 106 (Highways England et al, 2020b; page 6).
- Historic buildings – are defined as '*architectural works, works of monumental sculpture*' and '*groups of buildings recognised for their architecture, homogeneity or their place in the landscape*' provided by Note 1 and Note 2 of DMRB LA 106 (Highways England et al, 2020b; page 6).
- The historic landscape – comprises '*landscapes of historical, cultural or archaeological significance*' (Highways England et al, 2020, page 7; paragraph 1.4). For the purposes of this assessment the historic landscape has been divided into Historic Landscape Types (HLT), "*a distinctive and repeated combination of components define a generic historic landscape character type"* (Rippon, 2004, page 19).

14.1.5 This assessment is supported by the following appendices which are presented in Volume 1 - Part 6 (Appendices) of this report:

- *Appendix A14.1: Cultural Heritage Gazetteer*; and
- *Appendix A14.2: Criteria to inform the assessment of value (sensitivity) and the identification of key characteristics, features or elements of cultural heritage resources*.

Legislative and Policy Background

14.1.6 A summary of legislation and planning policies considered in the preparation of this chapter are identified below. Further information on national, regional and local planning policies is presented in Volume 1 – Part 3 – Environmental Assessment (Chapter 21: Policies and Plans) and Volume 1 – Part 6 – Appendices (*Appendix A21.1: Assessment of Policy Compliance*, Table 6).

<u>Legislation</u>

14.1.7 Scheduled Monuments are, by definition, of national importance and are protected by law under the Ancient Monuments and Archaeological Areas Act 1979 (as amended by the Historic Environment Scotland Act 2014). It is a criminal offence to damage a Scheduled Monument, and Scheduled

Monument Consent must be obtained from Historic Environment Scotland (HES) before any works affecting a Scheduled Monument may take place.

14.1.8 Listed Buildings are protected under the Planning (Listed Buildings and Conservation Areas) (Scotland) Act 1997 (as amended by the Historic Environment Scotland Act, 2014) and are recognised to be of special architectural or historic interest. Under Section 59 of the Act, in considering whether to grant planning permission for a development which affects a Listed Building or its setting, a planning authority or the Secretary of State (as the case shall be) is required to have special regard to the desirability of preserving the building or its setting, or any features of special architectural or historic interest which it possesses. Additional controls over demolition and alteration exist through the requirement for Listed Building Consent to be gained before undertaking alteration or demolition on a Listed Building. Under Schedule 5, Section 17.b. iv, of the Town and Country Planning (Development Management Procedure) (Scotland) Regulations 2013, planning authorities are required to consult HES on development proposals that may affect a category A listed building or its setting.

14.1.9 Under the Planning (Listed Buildings and Conservation Areas) (Scotland) Act 1997 (as amended by the Historic Environment Scotland Act 2014), listing may take into account not only the building itself but also how its exterior contributes to the architectural or historic interest of any group of buildings of which it forms part, and any feature of the building consisting of a man-made object or structure fixed to the building or forming part of the land and comprised within the curtilage of the building. Section 1 Paragraph 4 of the Act states that any object or structure fixed to a Listed Building and any object or structure within the curtilage of the building which, though not fixed to the building, forms part of the land and has done so since before 1st July 1948 shall be treated as part of the listing.

14.1.10 The Planning (Listed Buildings and Conservation Areas) (Scotland) Act 1997 (as amended by the Historic Environment Scotland Act 2014) imposes a duty on local planning authorities to designate and protect the historic character and appearance of some areas through their designation as Conservation Areas. These are areas of special architectural or historic interest, the character or appearance of which it is desirable to preserve or enhance. The main implication of this designation is that consent would be required for specific types of development that would not otherwise require it, such as 'Conservation Area Consent' for applications to demolish unlisted buildings in Conservation Areas.

14.1.11 The Ancient Monuments and Archaeological Areas Act 1979 (as amended by the Historic Environment Scotland Act 2014) requires HES to compile and maintain an Inventory of Gardens and Designed Landscapes and to compile and maintain an Inventory of Historic Battlefields. Under Schedule 5, Section 17.b. ii, of the Town and Country Planning (Development Management Procedure) (Scotland) Regulations 2013, planning authorities are required to consult HES on development proposals that may affect a historic garden or designed landscape. Similarly, under Schedule 5, Section 17.c., of the regulations, planning authorities are required to consult HES on development which may affect a historic battlefield.

Planning Policy

14.1.12 Scottish Planning Policy (SPP) (Scottish Government, 2014a; Revised December 2020), provides policy guidance on the cultural heritage resource. SPP highlights that the historic environment is a key cultural and economic asset and should be viewed as integral to creating successful places. It also acknowledges that the historic environment can accommodate change which is informed by a clear understanding of the importance of the cultural heritage resources affected. However, any change should be sensitively managed to avoid or minimise adverse impacts. Paragraphs 135 to 151 of SPP identifies policies relating to the historic environment. When significant elements of the historic environment are likely to be affected by development proposals, developers are required by the SPP to take the preservation of this significance into account in their proposals (paragraph 137).

14.1.13 Historic Environment Policy for Scotland (HEPS) (HES, 2019a) sets out the six principles for making decisions which affect the historic environment and forms part of a range of documents that inform decisionmakers in the Scottish planning system.

14.1.14 Policies 26 to 31 of the Perth & Kinross Council's (PKC's) Local Development Plan 2 (LDP) (Adopted 29th November 2019) (PKC, 2019) seek to protect cultural heritage from inappropriate development and shape the design of development to conserve and enhance cultural heritage.

14.1.15 Paragraphs 14.6.19 to 14.6.22 provide an assessment of the proposed route options compliance against plans and policies.

14.2 Approach and Methods

Scope and Guidance

14.2.1 This assessment was undertaken based on the guidance provided by DMRB LA 104 and DMRB LA 106. In addition to DMRB guidance and the policy documents identified in paragraphs 14.1.7 to 14.1.15, the following published policy and guidelines were taken into account in the preparation of this chapter:

- Planning Advice Note 2/2011: Planning and Archaeology (PAN2/2011) (Scottish Government, 2011);
- Piling and Archaeology Guidance and Good Practice (Historic England, 2019);
- Managing Change in the Historic Environment: Setting (HES, 2020a);
- Managing Change in the Historic Environment: Gardens and Designed Landscapes (HES, 2020b);
- Managing Change in the Historic Environment: Historic Battlefields (HES, 2020c);
- Designation Policy and Selection Guidance (HES, 2019b);
- The Criteria for Selection (UNESCO, 2021);
- Historic Environment Circular 1 (HES, 2016);
- Standard and guidance for historic environment desk-based assessment (Chartered Institute for Archaeologists (CIfA, 2020); and
- Environmental Impact Assessment Handbook: Guidance for competent authorities, consultation bodies, and others involved in the Environmental Impact Assessment process in Scotland (Scottish Natural Heritage and HES, 2018).

14.2.2 The approach and methods have been informed by the recommendations made in the A9 Dualling Programme Strategic Environment Assessment (SEA) (Transport Scotland, 2013). For cultural heritage these recommendations are presented in Section 6.1 of the SEA (Transport Scotland, 2013). In response to the SEA impacts on both designated and undesignated cultural heritage resources are considered as part of the DMRB Stage 2 assessment, and consultation with HES and Perth & Kinross Council (PKC) has been undertaken, and the results of this consultation taken account of in the DMRB Stage 2 assessment. More information on the SEA is presented in Volume 1, Part 3 – Environmental Assessment (Chapter 6: Summary of previous Environmental Assessment, paragraphs 6.5.3 and 6.5.4) of the DMRB Stage 2 Environmental Assessment.

14.2.3 The A9 Dualling Programme Environmental Design Guide Chapter 5 (Cultural Heritage) (Transport Scotland, 2015) builds on the SEA and makes reference to the assessment of designed and non-designated cultural heritage resources. The design guide presents a number of strategic environmental design principles, identifies route-wide issues, including DMRB Stage 2 requirements for cultural heritage, and section-specific issues including those for the Pass of Birnam to Tay Crossing project. The

strategic environmental design principles, DMRB Stage 2 requirements and section-specific issues for the Pass of Birnam to Tay Crossing were considered as part of this DMRB Stage 2 assessment.

14.2.4 The results of the cultural heritage assessment presented in this chapter have also been informed by the results of the landscape, visual, and noise and vibration assessments presented in Volume 1, Part 3 – Environmental Assessment (Chapter 12: Landscape), Volume 1, Part 3 – Environmental Assessment (Chapter 13: Visual), and Volume 1, Part 3 – Environmental Assessment (Chapter 16: Noise and Vibration).

Study Area

14.2.5 Informed by the guidance provided by paragraphs 3.6 and 3.6.1 of DMRB LA 106 (Highways England et al, 2020; page 9), to identify known cultural heritage resources that could be affected by the proposed route options, including as a result from changes to their setting, and to enable a robust comparative assessment of the proposed route options, study area was defined which extended 500m in all directions from the existing A9. Professional judgement was used to identify cultural heritage resources beyond 500m where the project has the potential to affect their setting. This approach was agreed with PKHT and HES (refer to paragraph 14.2.13). The location of the study area is shown on Figures 14.1 to 14.4 and Figures 14.10 to 14.13.

Baseline Conditions

14.2.6 To establish the cultural heritage baseline, the following sources of information were consulted:

- National Record of the Historic Environment for information on designated cultural heritage resources comprising World Heritage Sites, Scheduled Monuments, Listed Buildings, Conservation Areas, cultural heritage resources on the Inventory of Gardens and Designed landscapes and included on the Inventory of Historic Battlefields (accessed February 2021);
- Historic Landuse Assessment (HES, 2019c);
- the Perth and Kinross Heritage Trust's Historic Environment Record (HER) (received 11 March 2021);
- review of online historic mapping held by the National Library of Scotland (National Library of Scotland, 2019); and
- review of available LiDAR data accessed via the Scottish Remote Sensing Portal (August 2017).

14.2.7 A site inspection of Dunkeld, Two Standing Stones 450m WNW of Newtyle, Scheduled Monument (Asset 8), Dunkeld and Birnam Station including Footbridge, Category A Listed Building (Asset 26), The Lodge, Birnam, Category B Listed Building (Asset 19), Elsey Cottage, Birnam, Category C Listed Building (Asset 17), Birnam Bank Cottage, Birnam, Category C Listed Building (Asset 18) and Birnam Bank House, Birnam, Category C Listed Building (Asset 22) was undertaken on 6 July 2015. An additional site inspection of Murthly Castle Garden and Designed Landscape (HLT 14) between Roman Bridge Cottage and Birnam was undertaken on 29 November 2018.

14.2.8 To inform the assessment of value (sensitivity) of archaeological remains, the Scottish Archaeological Research Framework (ScARF) was used to identify relevant research objectives to which archaeological remains within the study area could potentially contribute information.

Consultation

14.2.9 A summary of the consultation is reported in Volume 1, Part 3 – Environmental Assessment (Chapter 7: Overview of Environmental Assessment, Section 7.6 (Consultation)). Key consultations that have informed this assessment are summarised in the following paragraphs.

14.2.10 In a letter of 23 March 2015, Jacobs requested information from HES for the whole of the A9 Dualling Programme on any additional sites within 500m of the existing A9 that were not included in their online dataset. In a letter of 10 April 2015 HES identified newly designated cultural heritage resources or cultural heritage resources whose designation was being reviewed; however, none of these additional cultural heritage resources are relevant to this project.

14.2.11 Under Section 1 Paragraph 4 of the Planning (Listed Buildings and Conservation Areas) (Scotland) Act 1997 (as amended by the Historic Environment Scotland Act 2014), listing may also include structures and additional buildings in proximity to a listed building, such as boundary walls and ancillary buildings. This is known as the curtilage of a listing. To decide whether curtilage listing applies, planning authorities consider if the structures and additional buildings were built before 1 July 1948 and were in the same ownership as the listed building at the time of listing, and whether they clearly relate to the listed building and still relate to it on the ground.

14.2.12 To establish the extent of the curtilage listing for Birnam Bank House, Birnam (Asset 22) and Dunkeld and Birnam Station including Footbridge (Asset 26) in an email of 17 April 2019 Jacobs asked PKC to confirm the extent of curtilage listing for these cultural heritage resources. In an email of 18 April 2019 PKC confirmed they were content that the extent of curtilage listing identified for Birnam Bank House, Birnam (Asset 22) was appropriate. For Dunkeld and Birnam Station including Footbridge (Asset 26) PKC agreed that the station forecourt and sidings have been altered since 1948. For the purposes of this assessment the altered station forecourt and sidings have therefore not been considered as part of the curtilage of Asset 26.

14.2.13 In a letter of 25 March 2021 PKHT and an email of 27 May 2021, HES confirmed that they were content with the approach to the cultural heritage inputs into the Stage 2 Environmental Assessment for the A9 Dualling programme: Pass of Birnam to Tay Crossing project including the criteria developed to inform the assessment of value (sensitivity) and the identification of key characteristics, features or elements of cultural heritage resources identified presented in *Appendix A14.2 (Criteria to inform the assessment of value (sensitivity) and the identification of key characteristics, features or elements of cultural heritage resources)*.

Impact Assessment

Value (sensitivity)

14.2.14 An assessment of value (sensitivity) of the cultural heritage resource was undertaken on a five-point scale of very high, high, medium, low and negligible, based on professional judgement and guided by the typical descriptions provided in Table 14.1, and the criteria agreed with HES and PKHT (paragraph 14.2.13) and presented in *Appendix A14.2 (Criteria to inform the assessment of value (sensitivity) and the identification of key characteristics, features or elements of cultural heritage resources)*.

Table 14.1: Environmental Value (sensitivity) and typical descriptions

Value (sensitivity) of receptor/resource	Typical description
Very High	Very high importance and rarity, international scale and very limited potential for substitution.
High	High importance and rarity, national scale, and limited potential for substitution.
Medium	Medium or high importance and rarity, regional scale and limited potential for substitution.
Low	Low or medium importance and rarity, local scale.
Negligible	Very low importance and rarity, local scale.

14.2.15 Legislation, policy and guidance relevant to the assessment of value (sensitivity) of a cultural heritage resource are identified in paragraphs 14.1.7 to 14.1.15.

Impact Magnitude

14.2.16 Magnitude of impact is the degree of change that would be experienced by a cultural heritage resource as a result of the proposed route options, in comparison with a 'do-nothing' scenario. Magnitude of impact is assessed without reference to the value (sensitivity) of the cultural heritage resource and may include physical impacts or impacts on its setting or amenity value.

14.2.17 Assessment of magnitude of impact was based on professional judgement informed by the typical descriptions provided in Table 14.2 and the criteria agreed with HES and PKHT and presented in *Appendix A14.2 (Criteria to inform the assessment of value (sensitivity) and the identification of key characteristics, features or elements of cultural heritage resources)*.

Table 14.2: Magnitude of impact and typical descriptions

Magnitude of impact (change)		Typical description
Major	Adverse	Loss of resource and/or quality and integrity of resource; severe damage to key characteristics, features or elements.
	Beneficial	Large scale or major improvement of resource quality; extensive restoration; major improvement of attribute quality.
Moderate	Adverse	Loss of resource, but not adversely affecting the integrity; partial loss of/damage to key characteristics, features or elements.
	Beneficial	Benefit to, or addition of, key characteristics, features or elements; improvement of attribute quality.
Minor	Adverse	Some measurable change in attributes, quality of vulnerability; minor loss of, or alteration to, one (maybe more) key characteristics, features or elements.
	Beneficial	Minor benefit to, or addition of, one (maybe more) key characteristics, features or elements; some beneficial impact on attribute or a reduced risk of negative impact occurring.
Negligible	Adverse	Very minor loss or detrimental alteration to one or more characteristics, features or elements.
	Beneficial	Very minor benefit to or positive addition of one or more characteristics, features or elements.
No Change		No loss or alteration of characteristics, features or elements; no observable impacts in either direction.

Significance of effect

14.2.18 For each cultural heritage resource, the significance of effect was determined taking account of the value (sensitivity) of the cultural heritage resource and the magnitude of impact. In accordance with the significance categories provided by Table 3.8.1 of DMRB LA 104 (Highways England et al, 2020a, page 14), significance of effect was assessed on a five-point scale of Very Large, Large, Moderate, Slight or Neutral using professional judgement informed by the matrix illustrated in Table 14.3. The five levels of significance of effect apply equally to adverse and beneficial impacts.

Table 14.3: Matrix for determination of significance

Magnitude of impact (Degree of Change) / Environmental value (Sensitivity)	No change	Negligible	Minor	Moderate	Major
Very High	Neutral	Slight	**Moderate** or **Large**	**Large** or **Very Large**	**Very Large**
High	Neutral	Slight	Slight or **Moderate**	**Moderate** or **Large**	**Large** or **Very Large**
Medium	Neutral	Neutral or Slight	Slight	**Moderate**	**Moderate** or **Large**
Low	Neutral	Neutral or Slight	Neutral or Slight	Slight	Slight or **Moderate**
Negligible	Neutral	Neutral	Neutral or Slight	Neutral or Slight	Slight

14.2.19 For the purpose of this assessment, potential effects of Moderate or greater categories are considered significant in the context of the Environmental Impact Assessment (EIA) Regulations and are highlighted in bold in Table 14.3.

Community Objectives

14.2.20 At an early stage in the A9 Co-Creative Process, the Birnam to Ballinluig A9 Community Group generated community objectives. The seven objectives are presented in Volume 1, Part 3 – Environmental Assessment (Chapter 7: Overview of Environmental Assessment) and cover a wide range of topics but focus predominantly on environmental issues.

14.2.21 The community objectives have been taken into consideration throughout the DMRB Stage 2 assessment process and a mapping exercise was conducted to indicate how, in the operational phase, the proposed route options could contribute to the objectives. Details of how each environmental topic contributes towards achieving the community objectives is presented in *Appendix A7.1: Mapping of Community Objectives Against DMRB Stage 2 Route Options* and a summary for this chapter is presented in Section 14.6 (Summary of Route Options Assessment).

Limitations to Assessment

14.2.22 Walkover surveys of the proposed route options and non-intrusive or intrusive archaeological investigations have not been undertaken. However, the sources of information consulted are appropriate to allow the robust assessment of value (sensitivity) of cultural heritage resources, magnitude of impact, significance of effect resulting from the proposed route options, the identification of significant effects, and the comparison of proposed route options.

14.3 Baseline Conditions

Summary

14.3.1 A total of 224 cultural heritage resources have been identified within the study area, as shown in Table 14.4. Of these, 48 are archaeological remains, 159 are historic buildings and 17 are historic landscape types (HLT), as summarised in the final column of Table 14.4. Further information on each cultural heritage resource is presented in the accompanying gazetteer (*Appendix A14.1: Cultural Heritage*

Gazetteer), and the locations of these cultural heritage resources are shown on Figures 14.1 to 14.14. No cultural heritage resources have been assessed to be of Very High value (sensitivity).

Table 14.4: Summary of cultural heritage resource values within the study area

Value (sensitivity) / Subtopic	Negligible	Low	Medium	High	Total
Archaeological Remains	25	11	9	3 (3 Scheduled Monuments)	48
Historic Buildings	0	27	4 (2 Conservation Areas)	128 (128 are listed buildings; one of which Asset 116 is also a Scheduled Monument)	159
Historic Landscape Types	6	5	2	4 (1 Inventory Battlefield and 3 Gardens and Designed Landscapes)	17
TOTAL	31	42	15	136	224

Archaeological Remains

14.3.2 A total of 48 archaeological remains have been identified within the study area. Of these, three are designated as Scheduled Monuments, and assessed to be of high value (sensitivity), as identified below:

- Dunkeld, Two Standing Stones 450m WNW of Newtyle (Asset 8) (approximately 430m from the existing A9);
- Torrvald, Farmstead 700m SW of Dunkeld House (Asset 85) (approximately 200m from the existing A9); and
- King's Seat Fort (Asset 188) (approximately 450m from the existing A9).

14.3.3 Dunkeld Cathedral (Asset 116; see Figure 14.9) is both a Scheduled Monument and a Category A Listed Building. Given the nature of this cultural heritage resource, Dunkeld Cathedral (Asset 116) is considered under the sub-topic of historic buildings (refer to paragraph 14.3.28).

<u>High Value (sensitivity) Archaeological Remains</u>

14.3.4 Dunkeld, Two Standing Stones 450m WNW of Newtyle (Asset 8; a Scheduled Monument) comprises a pair of standing stones located to the east of the A984. Standing stones were constructed throughout much of prehistory, but the majority are thought to have been erected in the Neolithic and Bronze Age periods (4100 BC to 800 BC) and form part of the larger megalithic culture that thrived throughout much of north-west Europe. The exact function of these monuments is not known, and interpretations vary from territorial markers to ritual locations.

14.3.5 Located at the foot of a steep wooded slope to the rear of a terrace overlooking the River Tay, the setting of Dunkeld, Two Standing Stones 450m WNW of Newtyle (Asset 8) comprises woodland, waste tips from the former quarry to the north, the adjacent A984 to the west and traffic noise and movement from this road. Views over the terrace and river south-west towards Birnam Hill are filtered by existing roadside trees. While the setting of this cultural heritage resource supports the understanding of the relationship of the monument's chosen location within the wider landscape roadside planting associated and the A984 reduces the ability to understand, appreciate and experience this relationship and as such setting does not significantly contribute to the value (sensitivity) of this cultural heritage resource. The key characteristics of Asset 8 comprise its physical remains, rarity and representativeness as an example of

this monument type in Scotland, and potential to contribute to our understanding of prehistoric ritual practices, which relate to national research themes identified in the Scottish Archaeological Research Framework (ScARF) including the arrangement and order of society and its religious systems (ScARF, 2012a; 2012b). These key characteristics and designation contribute to the value (sensitivity) of Asset 8, which has been assessed as high.

14.3.6 Torrvald, Farmstead 700m SW of Dunkeld House (Asset 85) is a Scheduled Monument that was first documented in 1566 and is of likely medieval origin (AD 400 to AD 1500). As a well-preserved deserted farmstead whose importance is significantly increased by its well-documented history, Torrvald Farmstead's physical remains and supporting documentary evidence have the potential to enhance our understanding of late medieval and early modern agriculture and settlement in Scotland. It is thought that the farmstead once stood in open farmland, but after a major programme of early 19th century afforestation that covered Craigvinean Hill, this cultural heritage resource's setting was modified and is now formed by coniferous woodland. As such the setting of Asset 85 does not significantly contribute to the value (sensitivity) of this cultural heritage resource. The key characteristics which contribute most to the value (sensitivity) of Asset 85 comprise the rarity of the surviving late medieval and early modern physical remains with supporting documentary evidence, and the potential of Asset 85 to significantly enhance our understanding of agriculture and settlement which relate to a number of national research themes identified by ScARF (ScARF, 2012d; 2012e). Based on these key characteristics and its designation, the value (sensitivity) of Asset 85 has been assessed to be high.

14.3.7 Defined by four concentric ramparts and terraces enclosing the central walled citadel, King's Seat Fort (Asset 188) is an early historic or Pictish (AD600 – AD900) defended settlement located on a prominent naturally defensive position overlooking the River Tay to the north-west, south and east (AOC Archaeology Group, 2017). It is likely that the position of the King's Seat Fort was chosen for its commanding views over the Tay valley. While these views are now limited by woodland, its location still contributes to our understanding and appreciation of Asset 188 as a high-status defensive settlement with strategically important views. The limited regional distribution of sites such as Asset 188 suggests that they may have been strongholds of a local elite and the recent archaeological excavations undertaken as part of the King's Seat Archaeological Project which identified well-preserved physical remains of historic or Pictish (AD600 – AD900) high status site including evidence of domestic activity, extensive metal working and international trade links (AOC Archaeology, 2017; 2018; 2019) support his interpretation. The key characteristics of Asset 188 include its physical remains, its significant contribution to our understanding of early historic Scotland, its social structures, economy and the material wealth of the people of the time, and the contribution long distance views and prominent position make to the value (sensitivity) of Asset 188. In consideration of these key characterises, potential to further contribute at a national level to a number of objectives in enclosure studies identified by ScARF (ScARF, 2012c) and designation as a Scheduled Monument, the value (sensitivity) of the Asset 188 has been assessed to be high.

Medium Value (sensitivity) Archaeological Remains

14.3.8 The conjectured sites of three former ecclesiastical buildings have been identified within Dunkeld. The Chapel of St Ninian's (Asset 119) is thought to be located within the grounds of Dunkeld Cathedral (Asset 116), while Holy Trinity Chapel (Asset 109) and a Friary (Asset 114) are thought to be located within Dunkeld between the High Street and the River Tay. While their exact location is unknown, the key characteristic of these cultural heritage resources comprises the potential for any buried physical remains associated with them to increase our understanding of regional medieval ecclesiastical activity and the development of Dunkeld as a religious administrative centre. These relate to a number of national research themes identified by ScARF (ScARF, 2012d) including the development of a clearer understanding of the relationship between liturgy and architecture. Based on the research potential for any physical remains associated with Assets 119, 109 and 114, the value (sensitivity) of these cultural heritage resources has been assessed to be medium.

14.3.9 Within Dunkeld House (HLT 19) designed landscape are two cultural heritage resources which have been assessed to be of medium value (sensitivity). These comprise the physical remains of the original Dunkeld House and a17th century structure interpreted as a tower (Asset 185) located approximately 70m north of Dunkeld Cathedral, and the conjectured site of the Bishops Tower House (Asset 107) approximately 100m west of Dunkeld Cathedral. The key characteristics which contribute most to the value (sensitivity) Asset 185, comprise the potential of any surviving physical remains to add to our understanding of Dunkeld House, and in the case of Asset 107, the potential for any physical remains to contribute our understanding of Dunkeld as a religious centre and could contribute more broadly to national research themes related to our understanding of the material conditions of the Church and how this affected people's lives at a regional level identified in ScARF (ScARF, 2012d).

14.3.10 Although construction was abandoned in 1842, the foundations of the new palace (Asset 178), commissioned by the 4th Duke of Atholl, have been traced as cropmarks. The key characteristics of Asset 178 comprise the physical remains of the new palace and its historical associations with the Dukes of Atholl, the pre-eminent regional family, which have some potential to increase our understanding of the development of high status houses during this period. In consideration of these key characteristics, and the potential for this monument type to contribute to research aims of understanding past landscape relationships in social, political and material terms as identified in ScARF (ScARF, 2012e), Asset 178 has assessed to be of medium value (sensitivity).

14.3.11 Unlike modern hospitals, medieval hospitals were more akin to hostels and alms houses. Before it was destroyed by fire in 1689, St George's Hospital (Asset 148) once stood on the corner of Cathedral Street and High Street in Dunkeld. While any physical remains associated with this cultural heritage resource are likely to be poorly preserved, this key characteristic of Asset 148 has the potential to make some contrition to our understanding of the development of medieval settlement associated with Dunkeld as an ecclesiastical centre and medical practises at the time. In consideration of this, Asset 148 has been assessed to be of medium value (sensitivity).

14.3.12 Dalpowie Lodge (site of) (Asset 5) was occupied from 1735 until the lodge was demolished in 1953. Originally known as 'The Hospital' it was built to house the 12 poorest men from the Grandtully, Strathbraan, Murthly and Airntully estates. In subsequent years it was known as Glen Birnam, Dalpowie Lodge, Birnam Hall and Dalpowie House, and was used as a private house, shooting lodge, Voluntary Auxiliary Hospital in World War I, troop billet and munitions store in World War II (McLennan, 2018). While land-take for the existing A9 removed much of the site of the principal buildings, archaeological remains of the ancillary buildings and gardens to the north survive. Dalpowie Lodge was home to William Drummond Stewart, 7th Baronet, a Scottish adventurer and British military officer who travelled extensively in the American West in the 1830s and was leased to the nationally important artist John Everett Millais (1829-1896) who paint a number of local landscape scenes. The key characteristics that contribute most to the value (sensitivity) of Asset 5 comprise the physical remains of the ancillary buildings and gardens, this cultural heritage resource's well-documentary history and association with William Drummond Stewart and Millais. In recognition of these key characteristic, their potential to make some contribution to our understanding of the development of gentry houses and estates in the region, as well as Dowpowie Lodge's strong community interest, the value (sensitivity) of Asset 5 has been assessed to be medium.

14.3.13 The 18th century Dunkeld to Inverness Military Road (Asset 192) was one of the first military roads conceived by Major General Wade (1673-1748) to improve communication within The Highlands and consolidate Government control in Scotland following the 1715 Jacobite Rising. While subsequent periods of road building on the alignment of Asset 192, including the existing A9 will have removed or truncated any physical remains of the Wade era road, there is some potential for physical remains associated with Asset 192 to still survive within later estate tracks. The key characteristics of Asset 192 comprise any surviving physical remains and their potential to contribute to our understanding of regional or local variations in construction techniques and materials employed by Wade. In consideration of these key characteristics, its historical association with General Wade and potential to contribute to

research themes relating to this monument type including those identified in ScARF relating to the internal ordering of the state and provide insights into Scottish and British identities (ScARF, 2012e), the value (sensitivity) of Asset 192 has been assessed to be medium.

Low Value (sensitivity) Archaeological Remains

14.3.14 Two cultural heritage resources associated with transport provide evidence for early crossing points of the River Tay. Asset 105 is the site of an early 16th century bridge and Asset 99 is the location of the Dunkeld to Inver ferry crossing which operated until 1808. While both cultural heritage resources key characteristics include their potential to provide evidence of the importance of Dunkeld and Inver as a crossing point of the River Tay, due to their lack of physical remains they can only make a limited contribution to our understanding of transport links at a regional and local level, and the value (sensitivity) of these cultural heritage resources has been assessed to be low.

14.3.15 Dunkeld To Inverness Military Road, Ledpetty Lodge To Dowally (site of) (Asset 193) was constructed partly in response to the 1715 Jacobite Rising, while the Coupar Angus to Amulree Military Road (site of) (Asset 101) dates to the period of the military road building overseen by Wade's successor Major Caulfeild (1698-1767). While any physical remains of Asset 193 are likely to have been damaged or removed by later road construction, some offline sections of Asset 101 do survive as forestry tracks. Their key characteristics comprise any surviving physical remains, Asset 101's potential to contribute to our understanding of local variations in construction techniques and materials employed by Caulfield, their historical associations and potential to contribute to research themes relating to military roads including those identified in ScARF (ScARF, 2012e). In recognition of these key characteristics, but in consideration of the limited potential for the survival of physical remains associated with the earliest period of military roads, the value (sensitivity) of these cultural heritage resource has been assessed to be low.

14.3.16 Due to the lack of known physical remains, the sites of Dunkeld Gaol (Asset 111) and Dunkeld Windmill (Asset 104) have limited potential to make a contribution to increasing our understanding of early civic and commercial activity within the settlement of Dunkeld, and Assets 111 and 104 have been assessed to be of low value (sensitivity). At the sites of Birnam Gas Works and Dunkeld Gas Works (Asset 11 and Asset 795) there remains the limited potential for the survival of physical remains that could increase our understanding of local energy production. Based on this key characteristic, the value (sensitivity) of these cultural heritage resources has been assessed to be low. The key characteristics that contribute most to the value (sensitivity) of Craig Ruenshin, Stock Enclosure and Shieling Hut (Asset 889), include its physical remains and their potential to contribution to our understanding of the seasonal agricultural settlements and practises at a local level. Shielings are a common monument type in upland areas, with over 600 record in Perth and Kinross, and the value (sensitivity) of this cultural heritage resource has therefore been assessed to be low.

14.3.17 The cropmark site at Ladywell (Asset 49) are the remains of field boundaries and trackways associated with the construction of the Highland Railway in the 1860s, while that at Inchmagrannachan (Asset 190) is a cropmark of unknown origin that does not appear to form coherent structures. Both were identified from aerial photographs. While the key characteristic of these cultural heritage resources are any buried physical remains, Asset 49 has limited potential to increase our understanding of Victorian railway construction methods, and cropmarks which are not representative of any specific monument type with limited research potential, the value (sensitivity) of Assets 49 and 190 has been assessed to be low.

Negligible Value (sensitivity) Archaeological Remains

14.3.18 As it is likely that later road construction has wholly or partially removed any physical remains associated with two non-military post-medieval roads within Birnam (Assets 30 and 40) these cultural heritage resources have been assessed to be of negligible value (sensitivity).

14.3.19 Eleven findspots have been identified within the study area. These are the find locations of artefacts, mainly coins and other metal objects, recovered from Dunkeld, Little Dunkeld, Birnam and Inver (Assets 82, 83, 92, 97, 102, 106, 118, 122, 125, 126 and 147). As unstratified objects (i.e. no longer in their original archaeological context) that have been removed, the key characteristic which contribute most to their value (sensitivity) is derived from their very limited potential to contribute to our understanding of the development of these settlements, and as such these cultural heritage resources have been assessed as negligible value (sensitivity).

14.3.20 Other recorded cultural heritage resources within the baseline include a fragment of a Cross Slab (Asset 130), the location of which is unknown, and a set of wrought iron gates now housed in a museum collection (Asset 170). Due to their very limited contribution to our understanding of the development of cross slab sculpture and the townscape of Dunkeld, they have been assessed as negligible value (sensitivity).

14.3.21 Asset 498 is the site of 20th century allotments located in an area of dense woodland described by the National Record of the Historic Environment as being abandoned. Asset 499 is identified as the former location of dykes, drystone or turf walls. While these cultural heritage resources are located within The Hermitage (HLT 20) designed landscape, they have not been identified as special feature of it. While the kay characteristics of Asset 498 and 499 include any surviving physical remains, post-medieval allotments and field boundaries are very common monument type, of which Assets 498 and 499 are poorly representative examples with very limited potential to contribute to our understanding of land use of this period, and as such have been assessed to be of negligible value (sensitivity).

14.3.22 The Mercat Cross in Dunkeld (Asset 168) was removed at the turn of the 19th century, and the now lost Deanscross Cross (Asset 12) is believed to have been erected by one of the deans of Dunkeld near Newtyle (now Deanscross) Cottage. The sites of two milestones and a toll house (Assets 797, 798, and 799) are recorded on the HER. Given the lack of physical remains associated with these cultural heritage resources, and the very limited contribution to our understanding of post-medieval transport systems of Assets 797, 798 and 799, these cultural heritage resources have been assessed to be of negligible value (sensitivity).

14.3.23 A quarry at Newtyle (Asset 9) has an associated building marked on the 1867 Ordnance Survey map as 'ruin', and a quarry at The Hermitage (Asset 66) and at Birnam (Asset 794) are depicted on the 1st Edition Ordnance Survey map (1867). As a very common monument type, the key characteristics of Assets 9, 66 and 794, including their physical remains, make a very limited contribution to our understanding of 19th century minerals industry and as such have been assessed to be of negligible value (sensitivity).

Historic Buildings

14.3.24 One hundred and fifty-nine historic buildings have been identified within the study area. Of these, three are designated as Category A Listed Buildings, 62 are Category B Listed Buildings, 62 are Category C Listed Buildings and two are Conservation Areas. The remaining 29 buildings are undesignated.

14.3.25 The Roman Bridge over Birnam Burn (Asset 4; Photograph 14.1; a Category A Listed Building), is a mid-19th century bridge built in a Roman aqueduct style in rustic masonry, with a heavily corbelled refuge at each spandrel, and crenelated parapet. It is currently included on the Buildings at Risk Register (reference number 5102). Birnam Burn Bridge (Asset 3; Photograph 14.2), a Category C Listed Building, is a single arched 19th century bridge approximately 15m south of Asset 4. Their setting comprises a heavily wooded gorge cut by the Birnam Burn and historical relationship with the western drive to Murthly Castle (HLT 14) designed landscape. The key characteristics which contribute most to the value (sensitivity) of Assets 4 and 3 comprise their high level of authenticity and completeness of design as examples of the architectural styles embodied in their surviving architectural detail and features, their contribution to our understanding of the development of the designed landscapes at a national and regional level, their setting, historical context in relation to the development of the design of Murthly

Castle (HLT 14) designed landscape. Based on these key characteristics and their designations, the value (sensitivity) of Assets 4 and 3 have been assessed to be of high.

Photograph 14.1: Roman Bridge over Birnam Burn (Asset 4), a Category A Listed Building, facing west

Photograph 14.2: Birnam Burn Bridge (Asset 3), a Category C Listed Building, showing the stone parapets and western drive, facing west

14.3.26 The Dunkeld Bridge over River Tay (Asset 100), a Category A Listed Building, was designed by Thomas Telford, and opened in 1809. The bridge is Telford's largest Scottish bridge, and its functionality is enhanced by modest embellishment in Gothic style that was successful in harmonising it with its dramatic surroundings (Paxton and Shipway, 2007). Its setting includes the tree lined south bank of the River Tay, its relationship with Dunkeld's historic townscape and the natural amphitheatre of woodlands and forested hills associated with Birnam Hill to the south, Craig Vinean to the west, Craig a Barns to the north-west, Crieff Hill to the north-east and Newtyle Hill to the east. The key characteristics of Asset 100 comprise its high level of authenticity and completeness of design evidenced by its surviving architectural detail, its setting and its historical associations with the nationally important civil engineer Thomas Telford. Given these key characteristics, including in recognition of Asset 100's architectural interest derived from the completeness of the original design and the significant contribution its historical interest makes to our understanding of social and economic history of the region, and its designation, the value (sensitivity) of Asset 100 has been assessed to be high.

14.3.27 Dunkeld and Birnam Station including Footbridge (Asset 26), was opened in 1856 and is a outstanding and well-detailed example of Scottish railway architecture in Tudor Cottage style by renowned architect Andrew Heiton Junior. The settlement of Birnam rapidly expanded following the opening of the Perth and Dunkeld Railway, largely in response to the development of early-mid Victorian Highland tourism industry. The setting of the station includes the public forecourt consisting of the ornamental front porch and car park (Photograph 14.3) and its relationship with other railway infrastructure such as the later signal box (Asset 16; Photograph 14.4). Originally the station would have been linked to Birnam by Station Road, but this connection was severed by the construction of the existing A9. There is vehicle access to the station car park via the existing A9, and a pedestrian link between the station and Birnam from Station Road under the existing A9 via Birnam Glen. Traffic movement and noise forms part of the setting of Asset 26. The key characteristics which contribute to the value (sensitivity) of Asset 26 comprise its rarity as an example of a largely compete early Scottish railway station retaining much of its original design architectural detail and features conceived by Andrew Heiton Junior, including its

ornate decorative scheme, its setting, and the contribution it makes to our understanding social and economic history of Birnam. Informed by these key characteristics and its designation as a Category A Listed Building, the value (sensitivity) of Asset 26 has been assessed to be high.

Photograph 14.3: Dunkeld and Birnam Station including Footbridge (Asset 26), a Category A Listed Building, showing the public forecourt including the porch of the north-facing elevation and car park, July 2015

Photograph 14.4: North-east facing elevation of Dunkeld and Birnam Station Signal Box (Asset 16), a Category B Listed Building, facing south-east

14.3.28 Dunkeld's early growth as a settlement is linked to its development as a focus of medieval pilgrimage and as a centre of ecclesiastical administration. Construction of Dunkeld Cathedral (Asset 116), a

Category A Listed Building and a Scheduled Monument, began in the 13th century and continued into the 16th century, with the Cathedral showing elements of Norman and Gothic architecture. The Cathedral fell into ruin during the Protestant Reformation of the 1560s and was badly damaged during the Battle of Dunkeld in 1689 (HLT 11), with the 13th century choir surviving intact as the parish church. The parts of the Cathedral that are scheduled date from a period of late medieval building campaigns instigated by Bishop Cardeny in 1406, consisting of a three-storey nave of seven bays, to which a south porch and north-west tower were added by Bishop Lauder before 1483. The Cathedral is located on the western edge of Dunkeld and linked via the ornamental gates (Asset 123) of the Cathedral precinct to the town by Cathedral Street. The Cathedral's setting comprises the public open space of the Cathedral precinct bordered by mature specimen trees which filter views to the south towards and across the River Tay and create a sense of intimacy and seclusion. To the north the setting is more open, with open pasture beyond the Cathedral precinct which rises towards wooded hills. Dunkeld Cathedral's key characteristics include its rarity as one of the most complete medieval Cathedrals in Scotland whose high level of authenticity and completeness of design makes a significant contribution to the Cathedral's architectural interest and the potential to provide an understanding of the development of the Cathedral complex through its physical remains and contemporary written accounts of the building's construction. In addition, Asset 116 makes a significant contribution to our understanding of religious institutions at a national level and played an important role during the battle of 1689. Given Asset 116's significant contribution to our understanding of medieval and later ecclesiastical architecture in Scotland and potential to further increase that understanding through its physical remains, historical interest and designations, the value (sensitivity) of Asset 116 has been assessed to be high.

14.3.29 The mid-18th century Dunkeld Cathedral precinct gates (Asset 123; a Category B Listed Building) formally served as the town gate for Dunkeld House (Asset 185) and were moved to their current position in the 19th century. The gate's key characteristics include their finely detailed metal work and contribution to our understanding of the continual development of the Cathedral precinct. In consideration of this, and Asset 123's designation, this cultural heritage resources has been assessed to be of high value (sensitivity).

14.3.30 Large parts of pre-17th century Dunkeld were destroyed by fire as a consequence of the 1689 Battle of Dunkeld (HLT 11) after which the town was rebuilt. Buildings dating to the 18th century including Evan Haxton's Property 6 Cathedral Street (Asset 134), 1 Cathedral Street (north side) (Asset 156) and The Ell House, The Cross, High Street (Asset 160). The key characteristics of these and similar buildings within Dunkeld include their high level of authenticity and completeness of design expressed through their 18th century architectural detail and features, and their contribution to our understanding of the development of Dunkeld after 1689. These key characteristics significantly contribute to the architectural and historic interest of these and other similar listed buildings, which have been assessed of be of high (sensitivity) value. Later commercial and civic buildings are similarly of architectural interest due to their original architectural detail or features. These include the Category C Listed Post Office (Asset 163), 19th century shops some of which retain their original shop fronts, including the Category B Listed K. Stanley & Sons on the High Street (Asset 161), and the ornate The Bank of Scotland (Asset 157), a Category C Listed Building. Based on their key characteristics, contribution to the townscape of Dunkeld and our understanding of the development and economy of the town from the 19th century, and their designations, these and similar listed buildings on Atholl Street, Bridge Street and Tay Terrace have been assessed to be of high value (sensitivity).

14.3.31 The Conservation Areas of Birnam and Dunkeld (Assets 44 and 103; refer to Figures 14.5, 14.6, 14.7, 14.8 and 14.9) reflect their contribution to our understanding of the period of development spanning the 18th and 19th centuries and have been assessed to be of medium value (sensitivity).

14.3.32 Birnam Conservation Area (Asset 44) encompasses buildings either side of Birnam Glen and Oak Avenue, Station Road, Birnam Terrace and Perth Road, as well as the north bank of the River Tay and Torr Hill. To the south-west the Conservation Area extends beyond the existing A9 to include an area of mid-Victorian villas which form a discreet group, whose setting includes their quiet secluded location, wooded gardens

and their relationship with each other, including The Lodge, Birnam (Asset 19; a Category B Listed Building) and Birnam Bank House, Birnam (Asset 22; a Category B Listed Building). The key characteristic of this group of buildings, are the architectural detail and features of their principal buildings, relationship to one another and large secluded wooded gardens which overlook Dunkeld and Birnam Station including Footbridge (Asset 26). This area is linked to the main settlement of Birnam by Birnam Glen which passes under the Highland Main Line railway and the existing A9.

14.3.33 The majority of historic buildings in Birnam Conservation Area characterise a significant period of urban expansion associated with the arrival of the Perth and Dunkeld Railway in 1856, and the subsequent growth of Birnam as a Victorian Highland resort. Examples include large mid-19th century villas and mansion houses, such as the Category B Listed Building Dunaird House, Torr Hill, Birnam (Asset 45) and the Category C Listed Buildings Oakbank House and Birnam Bank House (Assets 15 and 22). Domestic housing of various styles includes cottages such as Elsey and Birnam Bank Cottages (Assets 17 and 18; Category C Listed Buildings; Photograph 14.5), the Category C Listed Buildings forming Birnam Terrace (Assets 31, 34 to 37), and commercial buildings and seasonal accommodation, such as the Merryburn Hotel, Station Road, Birnam (Asset 32) and the Category B Listed Buildings of Murthly Terrace, Birnam (Assets 51, 53, 54 and 55). The key characteristics of these and similar buildings within Birnam including their high level of authenticity and completeness of design comprising a wide variety of architectural styles including Tudor and Scots Baronial, expressed through their architectural detail and features, and their contribution to our understanding of the development of Birnam as a Victorian Highland resort from the 1850s. These key characteristics significantly contribute to the architectural and historic interest of these and other similar listed buildings within Birnam, which have been assessed of be of high (sensitivity) value.

Photograph 14.5: Elsey Cottage and Birnam Bank Cottage (Assets 17 and 18), Category C Listed Buildings, within Birnam Conservation Area (Asset 44), July 2015

14.3.34 In addition to Dunkeld and Birnam Station including Footbridge (Asset 26), other historic buildings associated with the railway include the 1919 Dunkeld & Birnam Station Signal Box (Asset 16; a Category B Listed Building), the viaduct at Inver (Asset 71; a Category B Listed Building), the bridge over Hermitage Road and associated tunnel entrance (Asset 75; a Category C Listed Building) and The Hermitage tunnel (Asset 89) itself. The key characteristics of Dunkeld & Birnam Station Signal Box (Asset 16) comprise original architectural detail and features, including elements of the internal signalling mechanism, and the signal box's trackside setting, , its functional relationship with the Highland Main Line railway and Dunkeld and Birnam Station including Footbridge (Asset 26), and the way it is experienced. The key

characteristic, which contribute most to the value (significance) of Assets 71 and 75, comprise their architectural detail and features, such as the crenelated refuges, designed to harmonise with their surroundings and complement The Hermitage (HLT 20) designed landscape. In consideration of their contribution to our understanding of the development of Scottish railway architecture through their high level of authenticity and completeness of design and functional relationship with the Highland Main Line railway and designations, Assets 16, 26, 71 and 75 have been assessed to be of high value (sensitivity). In consideration of its limited architectural interest The Hermitage tunnel (Asset 89) has been assessed to be of low value (sensitivity).

14.3.35 Assets 76, 77, 79, 80, 86, 88 and 91 are a collection of 18th and 19th century domestic and former commercial buildings forming the historic core of Inver, and Asset 78 is a surviving example of a K6 telephone kiosk designed by Gilbert Scott. Asset 88 was home to the 19th century Scottish musician and composer Neil Gow. Their setting comprises the small settlement of Inver, traffic noise from the existing A9, and for Asset 91 limited views of the existing A9. These listed buildings retain a high level of authenticity and completeness of design expressed through their surviving architectural detail and features, which demonstrate local or regional building traditions that make a significant contribution to their architectural interest and that of Inver. In consideration of how these key characteristics contribute to their architectural interest, their designation as listed buildings and, in the case of Asset 88, its association with Neil Gow, these cultural heritage resources have been assessed to be of high value (sensitivity).

14.3.36 Historic buildings located outside the settlements within the study area include the mid-19th century Rohallion Buffalo Hut (Asset 6; a Category B Listed Building) once home to two Native Americans who were brought to the area by Sir William Drummond Stewart of Murthly Castle in the 1830s. Asset 6's setting includes long distance views towards Murthly Castle. The key characteristics of this unusual example of estate architecture, comprise its architectural detail and features, including its intricate detailing, conical roof and large gabled porch, historical associations and the contribution long distance views towards Murthly Castle makes to its value (sensitivity). Given the significant contribution these key characteristics make to the architectural and historical interest of Asset 6 and its designation, this cultural heritage resource has been assessed be of high value (sensitivity).

14.3.37 Farnyhaugh, Military Bridge (Asset 189) has been identified as a Wade era military bridge carrying the Dunkeld To Inverness Military Road (Asset 192) over a small watercourse. General Wade was instrumental in building a network of military roads in response to the 1715 Jacobite rebellion and this bridge has been attributed to his programme of 18th century military road building. The setting of Asset 189 includes its historical relationship with Asset 192 and woodland on the east bank of the River Tay. The key characteristics of Asset 189 include its historic associations with Dunkeld To Inverness Military Road (Asset 192), architectural details and features that could contribute to our understanding of construction techniques and materials using local and regional building traditions and its historical associations with Wade. Based on these key characteristics the value (sensitivity) of Asset 189 has been assessed to be medium.

14.3.38 Ringwood Lodge, Cottage (Asset 7) is a former much altered lodge associated with the western drive to Murthly Castle but now separated from it by the existing A9, which forms part of its setting. Deans Park (Asset 13) is a 19th century house in an enclosed garden and Inchmagrannachan Farmstead (Asset 191) has been converted to holiday accommodation. The key characteristics of Assets 7, 13 and 191 comprise their remaining architectural detail and features of these common building types which have the potential to contribute to our understanding of local building traditions. Due to their limited authenticity and completeness of design and limited architectural interest, these cultural heritage resources have been assessed to be of low value (sensitivity).

14.3.39 The Scottish War Memorial Project has recorded over 1,400 civic war memorials commemorating those lost to conflict from communities across Scotland (Scottish Military Research Group, 2021). Birnam War Memorial (Asset 497) is a 20th century memorial to those lost during both World Wars in the form of a

rubble stone cairn. Its setting comprises the knoll on which it sits, and the public open space and woodland that surround it. Existing traffic noise forms part of its setting. Designed to be seen when approached from Dunkeld, views to the north in parallel with the River Tay crossing are deliberately maintained. The key characteristics of Birnam War Memorial include its architectural detail and features, prominent position, public open space and maintained views. In consideration of its architectural interest and contribution to our understanding of the impact of conflict on surrounding communities, the value (sensitivity) of Asset 497 has been assessed to be low.

14.3.40 Birnam Milestone (Asset 800) on the B867 public road in Birnam records the distance between Perth and Dunkeld. Ladywell Milestone (Asset 43) is the record of a milestone however it is unclear from the available data as to whether this cultural heritage resource is still in situ. Milestones are of limited architectural interest but can contribute to our understanding of earlier forms of road transport infrastructure at a local level. In consideration of these key characteristics, Assets 800 and 43 have been assessed to be of low value (sensitivity).

Historic Landscape

14.3.41 Table 14.5 provides summary information on the 17 historic landscape types (HLT) identified within the study area, along with an assessment of their value (sensitivity). The locations of the HLTs are shown on Figures 14.10 to 14.13.

Table 14.5: Historic Landscape Types*

Number	Historic Landscape Type	Value (sensitivity)
HLT 1	17th to 19th Century Rectilinear Fields and Farms	Low
HLT 2	Managed Woodland	Low
HLT 3	19th Century to Present Coniferous Plantation	Negligible
HLT 4	19th Century to Present Urban Area	Negligible
HLT 5	17th to 18th Century Industrial Planned Village	Low
HLT 6	Recreation Area	Low
HLT 7	Medieval Village	Medium
HLT 10	Rough Grazing	Low
HLT 11	Dunkeld Battlefield	High
HLT 12	19th Century to Present Quarry	Negligible
HLT 14	Murthly Castle	High
HLT 15	Transport	Negligible
HLT 17	Freshwater Area	Negligible
HLT 19	Dunkeld House	High
HLT 20	The Hermitage	High
HLT 25	Medieval Town	Medium
HLT 26	Industrial or Commercial Area	Negligible

* Please note that Historic Landscape Types 8, 9, 13, 16, 18, 21, 22, 23 and 24 are outside the study area for the project and have therefore not been included in the baseline.

14.3.42 Of the 17 historic landscape types identified within the study area, four have been assessed to be of high value (sensitivity), two have been assessed to be of medium value (sensitivity) and five have been assessed to be of low value (sensitivity). The remaining six historic landscape types have been assessed to be of negligible value (sensitivity).

14.3.43 Recorded on the Inventory of Historic Battlefields, Dunkeld Battlefield (HLT 11) is located on the north bank of the River Tay and defines the area in which the main events of the battle of Dunkeld took place on 21 August 1689. The battle of Dunkeld was largely an urban engagement. The town, which was garrisoned by Government troops from the Cameronian Regiment under Lieutenant-Colonel William Cleland, was attacked by a much larger Jacobite force lead by Colonel Alexander Cannon. After the initial engagement at Schiochies Hill, also known as Stanley Hill, the Government troops withdrew into the town forcing the Jacobite forces to advance through narrow streets. After a period of bitter house to house fighting the Jacobite forces withdrew, leaving much of the town ablaze, but in Government hands. Despite superior numbers and the early loss of the Government commander and senior officers, the Jacobite forces failed to press home their advantage. The Government victory at Dunkeld weakened the Jacobite military leadership and prevented their advance south towards Perth and Stirling.

14.3.44 The key landscape characteristics of Dunkeld Battlefield (HLT 11) as identified from the Inventory of Historic Battlefields for the battle of Dunkeld (HES, 2018a) comprise:

- The flood plain location of Dunkeld on the north bank of the River Tay, hemmed in by the river and surrounding hills. This gave the Jacobite forces command of the higher ground to the north overlooking Dunkeld, while the river to the south constricted Government troop movements making it difficult for them to form a defensive position. However, the Government troops early withdrawal into the town forced the Jacobite army to use tactics they were unfamiliar with. This enabled the much smaller Government force to use the urban environment to their advantage as they withdrew into the core of the town around Dunkeld Cathedral (Asset 116), drawing the Jacobite forces slowly through the narrow streets.
- The hills to the north and west of Dunkeld, including Gallow Hill, that provided important vantage points from where the Jacobite commanders were able to observe the Government forces and direct their attack. Gallow Hill was also the location of the Jacobite cannon.
- Schiochies Hill where a detachment of Government troops was stationed and the location of the initial Jacobite attack.
- The site of Dunkeld House (Asset 185), to which the Government troops at Schiochies Hill withdrew following the initial engagement.
- The open ground between the Cathedral and Schiochies Hill, to the west of the Cathedral and the area between the Cathedral and the River Tay, now the Cathedral precinct, which at the time contained streets and houses. These areas saw the worst of the fighting, with the Jacobite forces attacking the Government troops from all directions.
- Unusual for a Scottish battle of the 17th and 18th century, the battle of Dunkeld took place in a largely urban environment. As a consequence of the battle, the majority of Dunkeld was destroyed and subsequently rebuilt, with areas to the north, south and west of the Cathedral undeveloped. However, the present townscape contributes to our understanding of the battle as having taken place in an urban environment.

14.3.45 The special qualities identified in the Inventory for Dunkeld Battlefield (HLT 11) identified from the Inventory of Historic Battlefields for the battle of Dunkeld (HES, 2018a) comprise:

- Areas of open ground forming the Cathedral precinct and the open fields to the north which at the time of the battle contained buildings forming part of the town. These areas were the focus of much of the urban fighting. Destroyed by the fighting, these areas remained largely undeveloped following the battle. Recent archaeological investigations in the area to the north of the Cathedral (Gondek and Driscoll, 2003; Kellog and Jones, 2003) have identified archaeological remains associated with the earlier town and the site of Dunkeld House. This suggests a high potential for the survival of buried archaeological remains associated with the battle in these areas.

- The Cathedral which was the focus of the Government forces final withdrawal, and still bears the physical scars of the battle with impact scars from musket fire visible on the eastern wall of the Cathedral.

14.3.46 In consideration of the key characteristics of HLT 11 comprising the significance of the battle in relation to 17th century Scotland history and our understanding of the first Jacobite Rising, the potential for the survival of physical remains associated with the battle which may provide further information on the battle itself and military tactics at the time, and inclusion on the Inventory of Historic Battlefields, Dunkeld Battlefield (HLT 11) has been assessed to be of high value (sensitivity).

14.3.47 Murthly Castle (HLT 14) is recorded on the Inventory of Gardens and Designed Landscapes as an outstanding landscape which makes a major contribution to the Tay Valley and provides an attractive setting for a number of Category A Listed Buildings. The present early 19th century layout overlays an early 17th century one. Murthly Castle lies in the centre of the policies (the grounds associated with a country house) which extend over some 862 hectares. The existing A9 runs through the western section of the designed landscape. To the south beyond the Highland Main Line railway, are extensive woodlands of the Muir of Thorn.

14.3.48 The key landscape features identified from the Inventory of Gardens and Designed Landscape entry for Murthly Castle (HES, 2018b) comprise:

- The south bank of the River Tay, which it dominates for several miles, including a bend in the River Tay which encloses the policies to the north of the designed landscape, and provides an extended riverfront.
- The foothills of the Highlands and the Forest of Clunie to the north, which act as a dramatic backdrop to the panoramic views north from the Castle (a Category A Listed Building; LB11146).
- The knoll or low hill upon which the Castle is sited, which provides an elevated position allowing the Castle to dominate the surrounding landscape and providing elevated views over and through the designed landscape.
- Birnam Burn whose rugged qualities were exploited as part of the early-19th century landscaping.

14.3.49 The special features of Murthly Castle designed landscape identified from the Inventory of Gardens and Designed Landscape entry (HES, 2018b) comprise:

- John Wallace's 1830s landscape design which enlarged and completely remodelled the parkland throughout the policies, creating two very distinct areas of parkland to the east and west of the Castle. Wallace's design sought to exploit the dramatic qualities of the site, particularly the panoramic views, and the rugged quality of Birnam Burn. The special features associated with Wallace's design include:
  - The eastern park, edged along the river bank by a long ha-ha wall, containing some of the oldest trees including sweet chestnuts, remnants of the original planting. The majority of the remaining parkland trees are beech, oak, horse chestnut and sycamore and date from various periods of planting.
  - The smaller western park divided by Branders Hill wood. Here the parkland trees only date to the 19th century, although the oak avenue is older.
  - The Cedar Avenue running along the western drive parallel to the existing A9.
  - The snaking drives threaded throughout the policies which exploit the dramatic landscape features of the site, particularly the panoramic views, and Birnam Burn. These included the riverside drive between Birnam in the west to Victoria Bridge at Gellyburn in the east.
  - The avenues created at different periods through the park remain significant features today. These include the avenue of limes and yew planted in c.1711, the Oak Avenue planted in c.1800

and a second in c.1870, the Beech Avenue planted in c.1800, the Wellingtonia Avenue that flanks part of the eastern drive and the Cedar Avenue which forms part of the western drive.

- The parkland and policies which provide a dramatic setting for a number of important buildings including the castle (LB11146), the walled garden and garden house (LB11147), the chapel of St Anthony the Eremite (LB13460) and the Roman Bridge (Asset 4), all Category A Listed Buildings.
- The garden laid out on a north/south axis between the castle and the chapel is thought to have been created by John Wallace, but subsequently altered. Three parallel walks follow the axis, the eastern walk forming a dramatic sunken terrace. A late-17th century walled garden is associated with the south wing of the castle.
- Originally forming part of Birnam Wood, much of the larger blocks of woodland are now coniferous plantations, however a few ancient deciduous trees and other specimen trees survive within areas of modern forestry.

14.3.50 The key landscape features and the approximate location and extent of special features as summarised above, have been interpreted from the 1st Edition Ordnance Survey map (1867) and aerial photography and are shown on Figure 14.14.

14.3.51 Based on the key characteristics HLT 14 articulated as the key landscape features and special features identified in paragraphs 14.3.48 and 14.3.49, and in consideration of its high artistic and nature conservation interest and outstanding historical, horticultural, architectural and scenic interest, and inclusion on the Inventory of Gardens and Designed Landscapes, Murthly Castle (HLT 14) has been assessed to be of high value (sensitivity).

14.3.52 Also recorded on the Inventory of Gardens and Designed Landscapes, Dunkeld House (HLT 19) designed landscape has existed for more than 250 years, as a formal 18th century design, then informalised in the 19th century. While once incorporating The Hermitage (HLT 20), the southern extent of the Inventory garden and designed landscape is defined by the north bank of the River Tay from the west of Craig a Barns to Dunkeld Cathedral precinct. Modern coniferous plantations on Craig a Barns form the northern edge of HLT 19, which extends east and north-east to the edge of Dunkeld and the A923.

14.3.53 The key landscape features of Dunkeld House (HLT 19), as identified from the Inventory of Gardens and Designed Landscape (HES, 2018c) comprise:

- The River Tay, which provides an important setting of the designed landscape around the present Dunkeld House and the policies on the north bank, providing the backdrop for the riverside paths between the house and Dunkeld Cathedral, including the Bishop's Walk.
- The surrounding coniferous woodlands and rugged hills on either side of the River Tay and the Braan valley, which enhance and dominate the overall landscape.
- The open parkland to the north and south of the 19th century east drive which passes through earlier 18th century parkland.

14.3.54 The special features of Dunkeld House (HLT 19) identified from the Inventory of Gardens and Designed Landscape entry (HES, 2018c) comprise:

- Its outstanding historical value due to its associations with the Dukes of Atholl and the 18th and 19th century accounts and other documentary evidence, which provide a detailed history of the development of the designed landscape.
- HLT 19's horticultural value as the site of one of the first larch plantations in Britain, and the important collection of specimen trees, including those within the Cathedral precinct such as yew, hemlock, larch and fir.

- The surviving architectural features forming part of the overall design, including the present Dunkeld House, the gazebo to the north of the terraced gardens and the terraced garden (Category C Listed Buildings; Asset 146, Asset 155 and Asset 110) and the east grotto, walled garden and Gallow Hill Lodge (Category B Listed Buildings; Asset 806, LB5606 and LB5571).
- The gardens which include the poorly preserved American Garden created in the mid-19th century and the lawns in the immediate vicinity of the present house.
- The sites of the original Dunkeld House and the house that began in 1828 but never completed (Assets 185 and 178).
- The east drive including stands of larch trees planted in 1750.
- The Bishop's Walk, a path that extends along the riverside from the east end of the American Garden to the Cathedral precinct.
- The remaining policy woodlands, which have been much reduced in size, of which the King's Seat Wood, west of the present Dunkeld House retains beech trees planted between c.1840 and 1860.
- Schiochies Hill, also known as Stanley Hill, a modified natural mound, landscaped and terraced in the 1720s, and used as a viewpoint in the 18th and 19th century across the park to the former Dunkeld House (Asset 185).

14.3.55 Based on the key characteristics of HLT 19 articulated as the key landscape features and special features identified in paragraphs 14.3.53 and 14.3.54, and in consideration of its outstanding artistic, historical, horticultural and scenic interest and high architectural interest, and inclusion on the Inventory of Gardens and Designed Landscapes, Dunkeld House (HLT 19) has been assessed to be of high value (sensitivity).

14.3.56 The Hermitage (HLT 20), an Inventory garden and designed landscape, is an outstanding example of 18th century picturesque landscape style. The Hermitage was originally designed as part of Dunkeld House (HLT 19) designed landscape, from which it became separated by the breakup of the Dunkeld Estate in the mid-20th century. While the boundary of The Hermitage defined on the Inventory of Gardens and Designed Landscapes extends north of the Highland Main Line railway, the ornate 1860s viaduct (Asset 71; a Category B Listed Building) and bridge (Asset 75; a Category C Listed Building) separate the significant features of The Hermitage (HLT 20) from the infrastructure associated with the National Trust for Scotland (NTS) visitor car park.

14.3.57 The key landscape features identified from the Inventory of Gardens and Designed Landscape entry for The Hermitage (HES, 2018d) comprise:

- The secluded valley setting and naturally dramatic deep gorge of the River Braan and its waterfalls and cascades, including the Falls of Braan. The Hermitage exploited the natural picturesque landscape as part of an 18th century sublime experience.
- The riverside woodland planting which restricts views of the river, while the sound of the water pounding over the Falls of Braan can be heard when approaching along the wooded paths. This is designed to add to the drama of the falls when finally viewed for the first time.
- The surrounding afforested hills, including Craigvinean hill to the north-west and the lower slopes of the Obney Hills and Birnam Wood, which add a natural dramatic backdrop to the picturesque, secluded valley.

14.3.58 The special features of The Hermitage identified from the Inventory of Gardens and Designed Landscape entry (HES, 2018d) comprise:

- Important architectural elements which form a significant part of the design, adding to the appreciation of the key landscape features. These comprise Ossian's Hall, a single storey Gazebo located on a precipice above the River Brann and Ossian's Cave a folly that is located upstream from

the hall (Category B Listed Buildings; LB11156 and LB11105), and Hermitage Bridge (a Category A Listed Building; LB11104) located beneath Ossian's Hall.

- Surviving specimen trees from the 19th century planting scheme, including beech, yew, monkey puzzle and silver fir.
- The walks which meander through the woodland and follow routes of the original paths shown on early Ordnance Survey maps.

14.3.59 Based on the key characteristics of HLT 20 articulated as the key landscape features and special features identified in paragraphs 14.3.57 and 14.3.58, and in consideration of it as an outstanding artistic, historical and architectural interest as an example of the 18th century picturesque landscape, high horticultural and nature conservation interest, and inclusion on the Inventory of Gardens and Designed Landscapes, The Hermitage (HLT 20) has been assessed to be of high value (sensitivity).

14.3.60 While the built heritage of Inver dates largely to the 18th century it makes some contribution to the architectural interest of HLT 7, and the pattern of the medieval village (HLT 7) can be seen in the layout of the current road system. Medieval town (HLT 25) includes some areas of Dunkeld. While the majority of the town was destroyed following the Battle of Dunkeld (HLT 11), part of the street pattern may have been preserved when the town was rebuilt. In consideration of the contribution their key characteristics, comprising documentary evidence and landscape components including historic buildings and the surviving road and street pattern, make to the architectural and historic interest and character of Inver and Dunkeld, HLT 7 and HLT 25 have been assessed as being of medium value (sensitivity).

14.3.61 Five HLTs have been assessed to be of low value (sensitivity). These comprise 17th to 19th Century Rectilinear Fields and Farms (HLT 1), Managed Woodland (HLT 2), 17th to 18th Century Industrial Planned Village (HLT 5), Recreation Area (HLT 6) and Rough Grazing (HLT 10). In consideration of their limited architectural and historic interest as evidence of the impacts on the agricultural landscape of Perthshire since the agricultural revolution and their historic interest that is manifested in their historic landscape components, such as the surviving field patterns and boundaries, a key characteristic of these HLTs, but reflecting the frequency of these types in the wider region, the value (sensitivity) of these five HLTs has been assessed to be low.

14.3.62 Five HLTs have been assessed to be of negligible value (sensitivity). These comprise 19th Century to Present Coniferous Plantation (HLT 3), 19th Century to Present Urban Area (HLT 4), 19th Century to Present Quarry (HLT 12), Transport (HLT 15) and Industrial or Commercial Area (HLT 26). These types have been created or significantly altered in the 20th century. In consideration of their very limited architectural and historic interest as evidence of the impacts on the agricultural and urban landscape of Perthshire since the late 19th century and their very limited historic interest that is evidenced by key characteristics, such as boundary features, but reflecting the frequency of these types in the wider region, the value (sensitivity) of these HLTs have been assessed to be of negligible value. Freshwater area (HLT 17), which includes lochs or rivers over 50m wide, has also been assessed to be of negligible value (sensitivity).

Future Baseline

14.3.63 This section provides a summary of the likely evolution of the future baseline for the cultural heritage resource without the proposed route options.

14.3.64 The PKC's Local Development Plan 2 identifies that for Dunkeld and Birnam '*the potential for additional development is highly constrained by potential flooding, the surrounding topography, and by various international and national natural and built heritage designations*' but recognises the potential '*for some small-scale infill residential development*' (PKC, 2019; page 192). Extant planning applications identified in Table 8.17 of Volume 1, Part 3 – Environmental Assessment (Chapter 8: Population - Land

use) are small-scale and require minimal land-take. Changes to the future baseline for the cultural heritage resource within the study area from development would therefore be limited.

14.3.65 It is predicted that Scotland will become warmer and wetter as a result of climate change, which is likely to lead to greater flood events. Volume 1, Part 3 – Environmental Assessment (Chapter 11: Road Drainage and the Water Environment) and Volume 1, Part 3 – Environmental Assessment (Chapter 19: Climate) describe the potential effects of climate change within the study area. For the cultural heritage resource within the study area impacts from climate change include a greater risk and intensity of flood events potentially damaging historic buildings and the loss of archaeological remains as a result of erosion.

14.4 Potential Impacts and Effects

Introduction

14.4.1 This section provides an introduction to the impact assessment of the proposed route options. The potential impacts detailed below are reported in line with the following:

- potential impacts represent those which could result from the construction or operation of the proposed route options;
- potential impacts are described without mitigation as mitigation to reduce these impacts would be developed for the Preferred Route Option during the DMRB Stage 3 assessment;
- the assessment of impacts is divided between those that are common to all proposed route options and those that differ between them; and
- unless otherwise stated all effects described below are adverse.

14.4.2 Potential impacts during construction can include direct physical impacts resulting in partial or complete removal of cultural heritage resources by construction activities and impacts on the settings of cultural heritage resources arising from construction activities and traffic.

14.4.3 During operation, potential impacts on the setting of cultural heritage resources can arise from the presence of new elements of infrastructure, lighting, visual intrusion by traffic and an increase in traffic noise. Impacts on the setting of cultural heritage resources are considered in this chapter.

14.4.4 This section also presents an assessment of potential impacts on cultural heritage resources associated with potential options to maintain access to Dunkeld and Birnam Station, including footbridge (Asset 26) (referred to in this chapter as 'access options') during construction and operation. Details of the access options are provided in Volume 1, Part 3 – Environmental Assessment (Chapter 7: Overview of Environmental Assessment, Section 7.2 (Identification of Route Options)) and can be summarised as follows:

- access option 1: Extend station platforms to the north to form a temporary station, with vehicular access provided to Platform 2 (northbound), via a new access road from the A822 (Old Military Road) and the replacement of the Highland Main Line railway bridge over Inchewan Burn.
- access option 2: Temporary pedestrian footbridge across the A9 construction site, from Birnam Industrial Estate to Dunkeld & Birnam Station, Platform 1 (southbound).
- access option 3: Extend station platforms to the north to form a temporary station, with vehicular access provided to Platform 2 (northbound), via a new access road from the A822 (Old Military Road), the replacement of the Highland Main Line railway bridge over Inchewan Burn and a temporary pedestrian footbridge across the A9 construction site, from Birnam Industrial Estate to Dunkeld & Birnam Station, Platform 1 (southbound).

- access option 4: Temporary pedestrian footbridge across Inchewan Burn, linking the existing Platform 2 (northbound) and the new access road from the A822 (Old Military Road).
- access option 5: Temporary pedestrian footbridge across the A9 construction site, from Birnam Industrial Estate to Dunkeld & Birnam Station, Platform 1 (southbound) and a temporary pedestrian footbridge across Inchewan Burn, linking the existing Platform 2 (northbound) and the new access road from the A822 (Old Military Road).

14.4.5 In the assessment of impact presented below it has been assumed that the access options are temporary with the exception of the following elements of access option 1 and access option 3 which would be retained during operation:

- the extension of Platform 1 (southbound) and Platform 2 (northbound) required as part of Option ST2A with access option 1 and access option 3, and Option ST2B with access option 1 and access option 3; and
- the replacement Highland Main Line railway bridge over Inchewan Burn required as part of Option ST2A with access option 1 and access option 3, and Option ST2B with access option 1 and access option 3.

Impacts and Effects Common to All Options

14.4.6 This section provides details on the potential impacts and effects which are common to all proposed route options during construction and operation. These impacts and effects are presented in Tables 14.6 and 14.7 and are described in the following paragraphs.

Construction

14.4.7 Accidental damage to the architectural detail and features which are a key characteristic of Farnyhaugh, Military Bridge (Asset 189) (refer to paragraph 14.3.37), may result from construction activities, including from construction plant, for a Sustainable Drainage Systems (SuDS) in the vicinity of it. Should accidental damage to Asset 189 occur as a result of construction, on a worst-case basis, this potential impact has been assessed to be of major magnitude and a potential effect of Large significance.

14.4.8 In addition to the risk of accidental damage, construction activities would introduce new sources of noise and visual intrusion into the setting of Farnyhaugh, Military Bridge (Asset 189), slightly affecting the historic relationship with Asset 192, a key characteristic of Asset 189 identified in paragraph 14.3.37. The impact on Asset 189 has therefore been assessed to be of minor magnitude and a potential effect of Slight significance.

14.4.9 Construction of the proposed route options would result in the complete removal of Auchlou (Asset 793), a historic building identified from the 1st Edition Ordnance Survey map (1867). The magnitude of impact on this non-designated cultural heritage resource has been assessed to be of major magnitude and a potential effect of Moderate significance.

14.4.10 Ringwood Lodge Cottage (Asset 7) is a former lodge to Murthly Castle (HLT 14). There would be no physical impact on the lodge and therefore it would retain the architectural detail and features that are a key characteristic of this cultural heritage resource identified in paragraph 14.3.38. Whilst construction of the proposed route options would bring the A9 closer and introduce noise and visual intrusion into the setting of the Asset 7, described in paragraph 14.3.38, views would be filtered by mature woodland. In addition, construction of the proposed route options would add to the separation between the lodge and the estate. This impact has been assessed to be of minor magnitude and a potential effect of Slight significance.

14.4.11 Whilst construction of the proposed route options, including Dalguise Junction, would be visible in filtered views from the north to the south-east from King's Seat Fort (Asset 188), a Scheduled

Monument, there would be no impact on the physical remains of Asset 188 that are the key characteristic of this cultural heritage resources (refer to paragraph 14.3.7). Views of the proposed route options would not be dominant and would not affect the ability to understand the choice of site as a prominent (defendable) location, providing views south to the bend of the River Tay and north-west and south-east into the Tay valley, a key characteristic of Asset 188, as well as views from the valley towards the fort. As such this impact has been assessed to be of negligible magnitude and a potential effect of Slight significance.

14.4.12 Construction of the proposed route options including ground preparation for an embankment supporting the widening of the River Tay crossing to the north would potentially partially remove any physical remains associated with a short section of the Dunkeld to Inverness Military Road (Asset 192), a key characteristic of this cultural heritage resource (refer to paragraph 14.3.13). Given that a short length of this cultural heritage resource could be removed, this impact has been assessed to be of minor magnitude and a potential effect of Slight significance.

14.4.13 Construction of the proposed route options, including the widening of the existing road corridor and construction of Dalguise Junction, would be visible in views of the River Tay to the south and the hills to the south and west from Dunkeld House (HLT 19) designed landscape which are a key landscape feature of HLT 19 (refer to paragraph 14.3.53). However, views of proposed route options these views would be filtered by existing mature riverside planting. Construction activities for the widening of the existing road corridor would further reinforce the severance of Dunkeld House and The Hermitage (HLT 20). This impact has been assessed to be of negligible magnitude and a potential effect of Slight significance.

14.4.14 Construction of the proposed route options, including changes to the current entrance to the NTS car park and widening of the existing road corridor, would result in changes to a small area of The Hermitage (HLT 20) as defined by the Inventory Gardens and Designed Landscape. While these changes would remove a small area of modern tree planting and slightly alter the current entrance to the NTS car park, the key landscape and special features of The Hermitage (HLT 20) summarised in paragraphs 14.3.57 and 14.3.58 would not be affected. Construction activities for the widening of the existing road corridor would further reinforce the severance of The Hermitage from Dunkeld House (HLT 19). This impact has been assessed to be of minor magnitude and a potential effect of Slight significance.

14.4.15 There would be no physical impact on the architectural detail and features of Roman Bridge, Over Birnam Burn (Asset 4; a Category A Listed Building) or Birnam Burn Bridge (Asset 3; a Category C Listed Building), that are the key characteristic of these cultural heritage resources (refer to paragraph 14.3.25), or on their immediate setting, which is formed by the heavily wooded gorge which they span, as a result of construction of the proposed route options. However, ground preparation and construction of the new access road, would temporarily affect the relationship between the bridges and the western drive of Murthly Castle (HLT 14) designed landscape of which they form a part. For Assets 4 and 3 this impact has been assessed to be of negligible magnitude and a potential effect of Slight significance.

14.4.16 While activities associated with the construction of the proposed route options would be visible and audible from Dunkeld and Birnam Station Signal Box (Asset 16), a Category B Listed Building, the relationship between the adjacent Highland Main Line railway and Dunkeld and Birnam Station including Footbridge (Asset 26), and the architectural detail and features that are the key characteristics of this cultural heritage resource (refer to paragraph 14.3.34), would not be affected. This impact has therefore been assessed to be of negligible magnitude and a potential effect of Slight significance.

14.4.17 There would be no physical impact on architectural detail and features of the cultural heritage resources which form the historic core of Inver (Assets 76, 77, 78, 79, 80, 86, 88 and 91), nor would there be impacts to the relationship between these cultural heritage resources, or their village setting within the settlement of Inver, which are the key characteristics of these cultural heritage resources (refer to paragraph 14.3.35). However, construction activities associated with the proposed route options would

be visible and audible from Craigview Cottages, Inver (Asset 91) and this impact has been assessed to be of negligible magnitude and a potential effect of Slight significance.

14.4.18 Construction of the proposed route options including ground preparation for widening of the existing road corridor and construction of an embankment to the south would potentially partly remove any physical remains associated with a short section of the Coupar Angus to Amulree Military Road (site of) (Asset 101) should they survive under the existing A9. The physical remains of Asset 101 are the key characteristic of this cultural heritage resource (refer to paragraph 14.3.15), however given that a short length of this cultural heritage resource would be removed, this impact has been assessed to be of negligible magnitude and a potential effect of Neutral significance.

14.4.19 Construction of the proposed route options would result in land-take from 17th to 19th Century Rectangular Fields and Farms (HLT 1). While this land-take would remove historic landscape components, such as field boundaries, a key characteristic of HLT 1 (refer to paragraph 14.3.61), this is a common landscape type along the A9 and the overall historic interest and legibility of the HLT would not be affected. All proposed route options would also result in the removal of small areas of Managed Woodland (HLT 2), 19th Century to Present Coniferous Plantation (HLT 3), 19th Century to Present Urban Area (HLT 4) and Recreational Area (HLT 6). Land-take in these areas would largely result from widening of the existing road corridor and would not affect the key characteristics of these cultural heritage resources which contribute to the legibility of these common and widespread HLTs (refer to paragraphs 14.3.61 and 14.3.62). These impacts have been assessed to be of negligible magnitude and a potential effect of Neutral significance.

14.4.20 All proposed route options have the potential to remove previously unrecorded archaeology. This potential is considered to be the same for all proposed route options and is not considered to be a differentiator between proposed route options.

Operation

14.4.21 The continued presence of the proposed route options would bring the A9 closer to Ringwood Lodge Cottage (Asset 7) and would be visible and audible from this cultural heritage resource. This impact has been assessed to be of minor magnitude and a potential effect of Slight significance.

14.4.22 Dalguise Junction would be visible in views from King's Seat Fort (Asset 188). Views towards the junction would likely be restricted by intervening vegetation, and the understanding of this cultural heritage resource as a defensive structure whose location took advantage of strategically important views, a key characteristic of Asset 188 (refer to paragraph 14.3.7), would not be affected. This impact has therefore been assessed to be of negligible magnitude and a potential effect of Slight significance.

14.4.23 While the continual presence of the SuDS pond would slightly change the setting of Farnyhaugh, Military Bridge (Asset 189), its historic relationship with Asset 192, a key characteristic of this cultural heritage resource (refer to paragraph 14.3.37), would be maintained. The impact on Asset 189 has therefore been assessed to be of minor magnitude and a potential effect of Slight significance.

14.4.24 During the operation of the proposed route options the negligible change to the historic landscape integrity of The Hermitage (HLT 20) would remain. This impact has been assessed to be of negligible magnitude and a potential effect of Slight significance.

14.4.25 The proposed route options may be visible in restricted views south of the River Tay from Dunkeld House (HLT 19) and the riverside walks including the Bishop's Walk, which have been identified as special features of the Inventory garden and designed landscape (refer to paragraph 14.3.54). This impact has been assessed to be of negligible magnitude and a potential effect of Slight significance.

14.4.26 There would be no changes to the relationship between Assets 76, 77, 78, 79, 80, 86, 88 and 91, or to their wider village setting within the settlement of Inver, a key characteristic of these cultural heritage resources (refer to paragraph 14.3.35), resulting from the continued presence of any of the proposed route options. Traffic movement may be visible and audible from Asset 91. This impact for Asset 91 has been assessed to be of negligible magnitude and a potential effect of Slight significance.

14.4.27 While the immediate setting of the Roman Bridge, Over Birnam Burn (Asset 4; a Category A Listed Building) and Birnam Burn Bridge (Asset 3; a Category C Listed Building) described in paragraph 14.3.25, would not change, the continued presence of any of the proposed route options would permanently realign the western drive of Murthly Castle (HLT 14) of which they form a part and is a key characteristic of these cultural heritage resources. For Assets 4 and 3 this impact has been assessed to be of negligible magnitude and a potential effect of Slight significance.

14.4.28 While the impacts from the removal of key characteristics (refer to paragraphs 14.3.61 and 14.3.62), including historic landscape components such as field boundaries, or changes in land-use during construction would continue into operation, the following HLTs would remain legible and their historic interest would not be affected: 17th to 19th Century Rectangular Fields and Farms (HLT 1), Managed Woodland (HLT 2), 19th Century to Present Coniferous Plantation (HLT 3), 19th Century to Present Urban Area (HLT 4) and Recreational Area (HLT 6). These impacts have been assessed to be of negligible magnitude and a potential effect of Neutral significance.

14.4.29 For Dunkeld and Birnam Station Signal Box (Asset 16) operational impacts are reported separately for each proposed route option.

Table 14.6: Summary of Potential Construction Impacts and Effects - Common to All Proposed Route Options

Asset No	Asset Name	Designation	Value (sensitivity)	Impact Description	Magnitude	Significance
3	Birnam Burn, Bridge	Category C Listed Building	High	Temporary changes to a key characteristic of this cultural heritage resource.	Negligible	Slight
4	Roman Bridge, Over Birnam Burn	Category A Listed Building	High	Temporary changes to a key characteristic of this cultural heritage resource.	Negligible	Slight
7	Ringwood Lodge, Cottage	None	Low	Temporary changes to the cultural heritage resource's setting, affecting a key characteristic of Asset 7.	Minor	Slight
16	Dunkeld and Birnam Station Signal Box	Category B Listed Building	High	Introduction of temporary noise and visual intrusion into its setting, affecting a key characteristic of this cultural heritage resource.	Negligible	Slight
91	Craigview Cottages, Inver	Category C Listed Building	High	Introduction of temporary visual and noise intrusion into its setting, affecting a key characteristic of this cultural heritage resource.	Negligible	Slight
101	Coupar Angus to Amulree Military Road (site of)	None	Low	Partial removal of any present physical remains, which are a key characteristic of this cultural heritage resource.	Negligible	Neutral
188	King's Seat Fort	Scheduled Monument	High	Introduction of temporary visual intrusion into its setting, affecting a key characteristic of this cultural heritage resource.	Negligible	Slight
189	Farnyhaugh, Military Bridge	None	Medium	Possible accidental damage to the architectural detail and features, which are a key characteristic of this cultural heritage resource.	Major	**Large**
				Introduction of temporary visual and noise intrusion into its setting, affecting a key characteristic of this cultural heritage resource.	Minor	Slight
192	Dunkeld to Inverness Military Road (site of)	None	Medium	Partial removal of any present physical remains, which are a key characteristic of this cultural heritage resource.	Minor	Slight
793	Auchlou	None	Low	Removal of this historic building.	Major	**Moderate**
HLT 1	17th to 19th Century Rectangular Fields and Farms	None	Low	Removal of historic landscape components, such as field boundaries, a key characteristic of this HLT, and changes in land-use.	Negligible	Neutral
HLT 2	Managed Woodland	None	Low	Land-take and changes in land-use.	Negligible	Neutral
HLT 3	19th Century to Present Coniferous Plantation	None	Negligible	Land-take and changes in land-use.	Negligible	Neutral

Asset No	Asset Name	Designation	Value (sensitivity)	Impact Description	Magnitude	Significance
HLT 4	19th Century to Present Urban Area	None	Negligible	Land-take and changes in land-use.	Negligible	Neutral
HLT 6	Recreational Area	None	Low	Land-take and changes in land-use.	Negligible	Neutral
HLT 19	Dunkeld House	Listed on the Inventory of Gardens and Designed Landscapes	High	Introduction of temporary visual intrusion into its setting and reinforcing the cultural heritage resource's severance with The Hermitage (HLT 20).	Negligible	Slight
HLT 20	The Hermitage	Listed on the Inventory of Gardens and Designed Landscapes	High	Land-take from the Inventory garden and designed landscape comprising a small area of modern tree planting and slightly altering the entrance to the NTS car park and reinforcing the cultural heritage resource's severance with Dunkeld House (HLT 19).	Minor	Slight

Table 14.7: Summary of Potential Operation Impacts and Effects - Common to All Proposed Route Options

Asset No	Asset Name	Designation	Value (sensitivity)	Impact Description	Magnitude	Significance
3	Birnam Burn, Bridge	Category C Listed Building	High	Permanent changes to a key characteristic of this cultural heritage resource.	Negligible	Slight
4	Roman Bridge, Over Birnam Burn	Category A Listed Building	High	Permanent changes to a key characteristic of this cultural heritage resource.	Negligible	Slight
7	Ringwood Lodge, Cottage	None	Low	Permanent changes to a key characteristic of this cultural heritage resource.	Minor	Slight
91	Craigview Cottages, Inver	Category C Listed Building	High	Permanent changes to a key characteristic of this cultural heritage resource.	Negligible	Slight
188	King's Seat Fort	Scheduled Monument	High	Permanent changes to a key characteristic of this cultural heritage resource.	Negligible	Slight
189	Farnyhaugh, Military Bridge	None	Medium	Permanent changes to a key characteristic of this cultural heritage resource.	Minor	Slight
HLT 1	17th to 19th Century Rectangular Fields and Farms	None	Low	Permanent changes in land-use.	Negligible	Neutral

Asset No	Asset Name	Designation	Value (sensitivity)	Impact Description	Magnitude	Significance
HLT 2	Managed Woodland	None	Low	Permanent changes in land-use.	Negligible	Neutral
HLT 3	19th Century to Present Coniferous Plantation	None	Negligible	Permanent changes in land-use.	Negligible	Neutral
HLT 4	19th Century to Present Urban Area	None	Negligible	Permanent changes in land-use.	Negligible	Neutral
HLT 6	Recreational Area	None	Low	Permanent changes in land-use.	Negligible	Neutral
HLT 19	Dunkeld House	Listed on the Inventory of Gardens and Designed Landscapes	High	Permanent changes to the setting of a special feature of the Inventory garden and designed landscape and reinforcement of the cultural heritage resource's severance with The Hermitage (HLT 20).	Negligible	Slight
HLT 20	The Hermitage	Listed on the Inventory of Gardens and Designed Landscapes	High	Permanent changes to the Inventory garden and designed landscape and reinforcement of the cultural heritage resource's severance with Dunkeld House (HLT 19).	Negligible	Slight

Impacts and Effects Specific to Option ST2A

14.4.30 This section provides details on the potential impacts and effects which are specific to Option ST2A during construction and operation. These potential impacts and effects are presented in Tables 14.8 and 14.9 and are described in the following paragraphs.

Construction

14.4.31 Option ST2A and any of the five access options would require construction in close proximity to Dunkeld and Birnam Station including Footbridge (Asset 26). For Option ST2A this includes contiguous bored piles (refer to Volume 1, Part 3 – Environmental Assessment (Chapter 16: Noise and Vibration, paragraphs 16.4.25 to 16.4.31). Should accidental damage occur as a result of construction and result in the loss of the architectural detail and features of the station building, a key characteristic of Dunkeld and Birnam Station including Footbridge (Asset 26) (refer to paragraph 14.3.27), on a worst-case basis this potential impact has been assessed to be of major magnitude and a potential effect of Very Large significance.

14.4.32 While the relationship between the station and other elements of railway infrastructure, such as the Dunkeld and Birnam Station Signal Box (Asset 16) would be retained, construction of Option ST2A and any of the five access options would partially remove the public forecourt (now the car park), which is an important element in this cultural heritage resource's setting and a key characteristic of Asset 26 (refer to paragraph 14.3.27), sever the pedestrian link between the station and Birnam from Station Road under the existing A9 via Birnam Glen, and reinforce the existing separation between the station and Birnam. While the station building is currently unoccupied, construction activities in close proximity to Asset 26, would restrict access, limiting its potential use during the construction period, and introduce noise and visual intrusion associated with the presence and operation of construction plant.

14.4.33 In addition to the changes identified in paragraph 14.4.32, the extension of Platform 1 (southbound) and Platform 2 (northbound) required as part of Option ST2A and access option 1 would result in a physical change to the platforms, which are an integral part of Dunkeld and Birnam Station including Footbridge (Asset 26). The platform extensions and the removal and replacement of the existing Highland Main Line railway bridge over Inchewan Burn, along with additional noise and visual impacts associated with the presence and operation of construction plant would be introduced into the setting of the station, diminishing the relationship between it and other elements of railway infrastructure which is a key characteristic of Asset 26 (see paragraph 14.3.27). The potential impact on Dunkeld and Birnam Station including Footbridge (Asset 26) resulting from these changes, and from the changes identified in paragraph 14.4.32, has been assessed to be of major magnitude and a potential effect of Very Large significance.

14.4.34 In addition to the impacts identified in paragraphs 14.4.32 and 14.4.33, Option ST2A and access option 3 also requires the provision of a new temporary pedestrian footbridge which would further erode the understanding of the relationship between the Dunkeld and Birnam Station including Footbridge (Asset 26) and other elements of railway infrastructure which is a key characteristic of Asset 26 (refer to paragraph 14.3.27). The potential impact on Dunkeld and Birnam Station including Footbridge (Asset 26) resulting from this and from the changes identified in paragraphs 14.4.32 and 14.4.33 has been assessed to be of major magnitude and a potential effect of Very Large significance.

14.4.35 While the construction of Option ST2A with access option 2 would not require physical changes to the station platforms or to the existing Highland Main Line railway bridge over Inchewan Burn, in addition to the changes identified in paragraph 14.4.32 provision of a new temporary pedestrian footbridge would diminish the relationship between Asset 26 and other elements of railway infrastructure (refer to paragraph 14.3.27). The potential impact on Dunkeld and Birnam Station including Footbridge (Asset 26) resulting from the provision of this temporary pedestrian footbridge and from the changes identified

in paragraph 14.4.32 has been assessed to be of major magnitude and a potential effect of Very Large significance.

14.4.36 Construction of Option ST2A with access option 4 would not require physical changes to the station platforms or to the existing Highland Main Line railway bridge over Inchewan Burn. It would also avoid changes to the setting of the station resulting from the extended platforms, replacement to the Highland Main Line railway bridge over Inchewan Burn or the provision of a temporary pedestrian footbridge. Construction of Option ST2A with access option 4 would however result in the changes identified in paragraph 14.4.32. The potential impact on Dunkeld and Birnam Station including Footbridge (Asset 26) resulting from these changes has been assessed to be of major magnitude and a potential effect of Large significance.

14.4.37 While the construction of Option ST2A with access option 5 would not require physical changes to the station platforms or to the existing Highland Main Line railway bridge over Inchewan Burn, in addition to the changes identified in paragraph 14.4.32 provision of a new temporary pedestrian footbridge would diminish the relationship between Dunkeld and Birnam Station including Footbridge (Asset 26) and other elements of railway infrastructure, this relationship is a key characteristic of Asset 26 (refer to paragraph 14.3.27). The potential impact on Dunkeld and Birnam Station including Footbridge (Asset 26) resulting from the provision of this temporary pedestrian footbridge and from the changes identified in paragraph 14.4.32 has been assessed to be of major magnitude and a potential effect of Very Large significance.

14.4.38 Construction of Option ST2A, including the new access road connecting to the western drive, Murthly Junction and three SuDS ponds, would result in land-take from Murthly Castle (HLT 14) an Inventory garden and designed landscape. While construction activities would reinforce the existing severance of the western end of HLT 14 and Birnam, which were once connected by a riverside drive running between Birnam and Victoria Bridge at Gellyburn, and the majority of the designed landscape to the east, the physical connection to Birnam and the route of the former riverside drive would be maintained. Although the Cedar Avenue, a feature of the western drive, would be retained, there is the possibility of accidental damage to it resulting from construction activities. These activities would also partially remove any surviving fabric and change the alignment of the western drive. While the Cedar Avenue and western drive are special features of HLT 14, the key landscape features and remaining special features identified in the Inventory of Gardens and Designed Landscapes and summarised in paragraphs 14.3.48 and 14.3.49 and shown on Figure 14.14, would not be affected. This potential impact has been assessed to be of moderate magnitude and a potential effect of Large significance.

14.4.39 Construction of Option ST2A including ground preparation for the widened carriageway, Murthly Junction, new access road running parallel to the western drive to Murthly Castle (HLT 14) and a SuDS pond, would remove any surviving physical remains of the enclosures and gardens of Dalpowie Lodge (site of) (Asset 5), a key characteristic of this cultural heritage resource (refer to paragraph 14.3.12), to the north and west of the ancillary buildings depicted on early Ordnance Survey mapping. This potential impact has been assessed to be of moderate magnitude and a potential effect of Moderate significance.

14.4.40 Option ST2A and any of the five access options would require construction of Birnam Glen access road, including a new crossing over Inchewan Burn, and a SuDS which would be partially within Birnam Conservation Area (Asset 44) and which would remove an area of woodland to the north-west of Inchewan Burn. Construction activities would introduce visual and noise intrusion into its setting and reinforce the existing severance of the area of Birnam Conservation Area to the south-west of the existing A9 and the Highland Main Line railway from that to the north-east.

14.4.41 In addition to the potential impacts identified in paragraph 14.4.40 construction of Option ST2A with access option 1 or access option 3 would require the removal of additional woodland to the south-west of Birnam Conservation Area (Asset 44) for a temporary car park facility, and the removal and replacement of the existing Highland Main Line railway bridge over Inchewan Burn, which is located

within the Conservation Area. The potential impact resulting from these changes and those described in paragraph 14.4.40 has been assessed to be of moderate magnitude and a potential effect of Moderate significance.

14.4.42 While the temporary pedestrian access would be partially located within Birnam Conservation Area (Asset 44) construction of Option ST2A with access option 2 would not require the removal of additional woodland to the south-west of Birnam Conservation Area (Asset 44) for a temporary car park facility or the removal and replacement of the existing Highland Main Line railway bridge over Inchewan Burn, which is located within the Conservation Area. Construction of Option ST2A with access option 2 would however result in the changes identified in paragraph 14.4.40. The potential impact resulting from these changes has been assessed to be of minor magnitude and a potential effect of Slight significance.

14.4.43 Construction of Option ST2A with access option 4 would require removal of additional woodland to the south-west of Birnam Conservation Area (Asset 44) for a temporary car park facility and construction of a temporary pedestrian footbridge over Inchewan Burn within the Conservation Area but would not require the removal and replacement of the existing Highland Main Line railway bridge over Inchewan Burn. The potential impact resulting from these changes has been assessed to be of minor magnitude and a potential effect of Slight significance.

14.4.44 Construction of Option ST2A with access option 5 would require removal of additional woodland to the south-west of Birnam Conservation Area (Asset 44) for a temporary car park facility, construction of a temporary pedestrian footbridge over Inchewan Burn and the provision of a new temporary pedestrian footbridge partly within the Conservation Area but would not require the removal and replacement of the existing Highland Main Line railway bridge over Inchewan Burn. The potential impact resulting from these changes has been assessed to be of minor magnitude and a potential effect of Slight significance.

14.4.45 The setting of six Category B and C Listed Buildings (Assets 14, 15, 17, 18, 19 and 22) located to the south-west of the Highland Main Line railway, comprise their quiet secluded location, wooded gardens and the buildings relationship with each other forming a discreet group. While construction activities would introduce visual and noise intrusion into the setting of these six Category B and C Listed Buildings, the key characteristics of these cultural heritage resources comprising their architectural detail and features, large secluded wooded gardens and relationship with each other (refer to paragraph 14.3.32) would not be affected. The potential impacts on the six Category B and C Listed Buildings (Assets 14, 15, 17, 18, 19 and 22) have been assessed to be of minor magnitude and a potential effect of Slight significance.

14.4.46 Construction of the Birnam Glen access road would remove part of the boundary wall and slightly reduce the size of the garden of Birnam Bank House, Birnam (Asset 22), a Category C Listed Building. A boundary feature is depicted on the 1st Edition Ordnance Survey map (1867) on the same alignment as the boundary wall enclosing the gardens to the south-west of Asset 22. While not specifically mentioned in the listed building description for Birnam Bank House, PKC has confirmed that the boundary wall forms part of the curtilage of this cultural heritage resource, and as such its removal or alteration would require Listed Building Consent (refer to paragraph 14.2.13). However, the loss of a section of boundary wall and the reduction in the size of the garden would not affect the key characteristics of Asset 22 as a mid-Victorian villa which are its architectural detail and features, (refer to paragraph 14.3.32), or its value (sensitivity). This potential impact has been assessed to be of minor magnitude and a potential effect of Slight significance.

14.4.47 Assets 25, 27, 28, 31, 34, 35, 36 and 37 are mid-Victorian terraced houses on Birnam Terrace and Gladstone Terrace, and Asset 32 is a hotel facing Station Road. Their setting comprises their roadside location, relationship to each other as terraced houses and Birnam Conservation Area to the north of the Highland Main Line railway. The character of the Conservation Area to the north of the Highland Main Line railway comprises a small settlement of well-designed mostly mid-Victorian houses and commercial buildings illustrating the growth of Birnam following the introduction of the railway. While

construction activities for the tunnel would be visible from the rear of Assets 25, 27, 28, 31, 32, 34, 35, 36 and 37, and would introduce new sources of noise intrusion, these changes to their setting would not affect their key characteristics (i.e. their architectural detail and features, our understanding of them as part of the early development of Birnam and their relationship to each another (refer to paragraph 14.3.33). In addition, while construction activities associated with the improvements to Station Road would be visible and audible from Asset 32, this would not affect its architectural detail and features and our understanding of it as a roadside hotel (refer to paragraph 14.3.33). Views towards the construction activity on Station Road from Assets 25, 27, 28, 31, 34, 35, 36, 37 and 38 would be screened by existing buildings, and these cultural heritage resources would not be affected. The potential impact on these nine Category B and C Listed Buildings in Birnam Conservation Area (Asset 44) to the north-west of the Highland Main Line railway (Assets 25, 27, 28, 31, 32, 34, 35, 36 and 37) has been assessed to be of minor magnitude and a potential effect of Slight significance.

14.4.48 Construction activities associated with the re-alignment of Inchewan Burn and the regrading of the channel between the existing A9 overbridge and Perth Road Bridge would introduce new sources of visual intrusion into the setting of Java House, Birnam (Asset 56; a Category C Listed Building). While the setting of Asset 56 comprises its secluded location within Birnam Conservation Area, its value (sensitivity) is derived from its key characteristics which are the architectural detail and features that contribute to the understanding of it as a former police station, which would not be affected. This potential impact has therefore been assessed to be of negligible magnitude and a potential effect of Slight significance.

14.4.49 Construction activities for Dunkeld Junction would remove a small area of the woodland at the base of the knoll on which Birnam War Memorial (Asset 497) sits and would introduce new sources of noise and visual intrusion into its setting. However, the key characteristics of Asset 497 described in paragraph 14.3.39 and comprising its architectural detail and features, the public open space that surrounds it, the maintained views to the north in parallel with the Tay crossing and its commemorative function, would not be affected. In addition, views of the construction activity would be filtered by the retained woodland. This potential impact has been assessed to be of negligible magnitude and a potential effect of Neutral significance.

Operation

14.4.50 Changes to the setting of Dunkeld and Birnam Station including Footbridge (Asset 26), resulting from the loss of the public forecourt, a key characteristic of this cultural heritage resource (refer to paragraph 14.3.27), would continue into operation.

14.4.51 For Option ST2A with access option 1 and access option 3 there would be an additional change to the setting of the station during operation due to the continued presence of the extension to Platform 1 (southbound) and Platform 2 (northbound) and the replacement of the existing Highland Main Line railway bridge over Inchewan Burn. For ST2A and access option 1 and access option 3 the potential impact resulting from these changes and those identified in paragraph 14.4.50 to Dunkeld and Birnam Station including Footbridge (Asset 26), has been assessed to be of moderate magnitude and a potential effect of Large significance.

14.4.52 The extension to Platform 1 (southbound) and Platform 2 (northbound) and the removal and replacement of the existing Highland Main Line railway bridge over Inchewan Burn, is not required for Option ST2A and access option 2, access option 4, and access option 5. However, the changes to the setting of Dunkeld and Birnam Station including Footbridge (Asset 26), resulting from the loss of the public forecourt, a key characteristic of this cultural heritage resource (refer to paragraph 14.3.27), would continue into operation. The potential impact from this change has been assessed to be of moderate magnitude and a potential effect of Moderate significance.

14.4.53 The continued presence of the A9 in a tunnel would restore the physical connection between Dunkeld and Birnam Station including Footbridge (Asset 26) and Birnam and allow the reinstatement of a key characteristic of Asset 26 (refer to paragraph 14.3.27), the public forecourt, to the north-east. Improved access to Asset 26 would facilitate opportunity for the sustainable re-use of the building. This potential impact has been assessed to be of moderate magnitude and a potential effect of Large beneficial significance.

14.4.54 Potential impacts from the removal of historic landscape elements, including areas of woodland at Dalpowie Plantation, and changes in land-use during construction would continue during operation due to the presence of Option ST2A within Murthly Castle (HLT 14) Inventory garden and designed landscape. This would permanently reinforce the existing severance of the western end of HLT 14 and Birnam from the designed landscape to the east, affecting the western drive, which is a special feature of the Inventory garden and designed landscape (refer to paragraphs 14.3.48 and 14.3.49). This potential impact has been assessed to be of moderate magnitude and a potential effect of Large significance.

14.4.55 The potential impact resulting from changes to the character of Birnam Conservation Area (Asset 44), for example due to a new Birnam Glen access road, from the new crossing over Inchewan Burn and the presence of a SuDS pond, would continue during operation. Operation of Option ST2A and any of the access options would also reinforce the existing severance of the Birnam Conservation Area (Asset 44) to the south-west of the existing A9 and Highland Main Line railway from the rest of the Conservation Area to the north-east.

14.4.56 In addition to the changes identified in paragraph 14.4.55 the changes to the character of Birnam Conservation Area (Asset 44) due to the replacement Highland Main Line railway bridge over Inchewan Burn required as part of Option ST2A with access option 1 or access option 3 would also continue during operation. Operation of Option ST2A with access option 1 or access option 3 would also continue to reinforce the severance of Birnam Conservation Area south-west of the Highland Main Line railway from the rest of the Conservation Area. The potential impact resulting from these changes and those described in paragraph 14.4.55 has been assessed to be of moderate magnitude and a potential effect of Moderate significance.

14.4.57 Option ST2A with access option 2 would not require a temporary car park facility or removal and replacement of the Highland Main Line railway bridge over Inchewan Burn. Operation of Option ST2A with access option 2, access option 4 or access option 5 would however result in the changes to the character of Birnam Conservation Area (Asset 44) identified in paragraph 14.4.55. The potential impact resulting from these changes has been assessed to be of minor magnitude and a potential of Slight significance. Operation of Option ST2A with access option 4 and access option 5 would result in the changes to the character of Birnam Conservation Area (Asset 44) identified in paragraph 14.4.55. The potential impact resulting from these changes has been assessed to be of minor magnitude and a potential effect of Slight significance.

14.4.58 The potential impact resulting from the presence of the Option ST2A, including the new Birnam Glen access road and SuDS, along with any of the access options on the setting of six listed buildings (Assets 14, 15, 17, 18, 19 and 22) would continue into operation. However, the key characteristics of these listed buildings which are their architectural detail and features, large secluded wooded gardens and relationship with each other (refer to paragraph 14.3.32) would not be affected. The potential impacts on six Category B and C Listed Buildings (Assets 14, 15, 17, 18, 19 and 22) have been assessed to be of minor magnitude and a potential effect of Slight significance.

14.4.59 The continued presence of Option ST2A in a tunnel would remove the existing A9 from the setting of Dunkeld and Birnam Station Signal Box (Asset 16), a Category B Listed Building. This would reinforce the existing relationship between it and the adjacent Highland Main Line railway and Dunkeld and Birnam Station including Footbridge (Asset 26), a key characteristic of Asset 16 (refer to paragraph

14.3.34). This potential impact has been assessed to be of minor magnitude and a potential effect of Slight beneficial significance.

14.4.60 While the potential impacts from the loss of a section of boundary wall and a small part of the garden of Birnam Bank House, Birnam (Asset 22), a Category C Listed Building would continue into operation, this would not affect the key characteristics of Asset 22 as a mid-Victorian villa which are its architectural detail and features, or its value (sensitivity). The potential impact has been assessed to be of negligible magnitude and a potential effect of Slight significance.

14.4.61 While Dunkeld Junction may be visible and traffic noise audible from Birnam War Memorial (Asset 497) and the public open space surrounding it, views towards Dunkeld Junction would be filtered by the retained woodland. Important views to the north in parallel with the River Tay crossing, a key characteristic of this cultural heritage resource (refer to paragraph 14.3.39), would be maintained and the commemorative function of Asset 497 would not be affected. This potential impact has been assessed to be of negligible magnitude and a potential effect of Neutral significance.

Table 14.8: Summary of Potential Construction Impacts and Effects – Option ST2A

Asset No	Asset Name	Designation	Value (sensitivity)	Impact Description		Magnitude	Significance
5	Dalpowie Lodge (site of)	None	Medium	Removal of any physical remains, a key characteristic of this cultural heritage resource, present within the footprint of the proposed route option.		Moderate	**Moderate**
14	Craigmore House, Birnam	Category B Listed Building	High	Temporary noise and visual intrusion into its setting from construction activities.		Minor	Slight
15	Oakbank House, Birnam	Category C Listed Building	High	Temporary noise and visual intrusion into its setting from construction activities.		Minor	Slight
17	Elsey Cottage, Birnam	Category C Listed Building	High	Temporary noise and visual intrusion into its setting from construction activities.		Minor	Slight
18	Birnam Bank Cottage, Birnam	Category C Listed Building	High	Temporary noise and visual intrusion into its setting from construction activities.		Minor	Slight
19	The Lodge, Birnam	Category B Listed Building	High	Temporary noise and visual intrusion into its setting from construction activities.		Minor	Slight
22	Birnam Bank House, Birnam	Category C Listed Building	High	Temporary noise and visual intrusion into its setting from construction activities.		Minor	Slight
				Removal of part of the boundary wall and garden.		Minor	Slight
25	Gladstone Terrace, Terrace Block House, Birnam	Category C Listed Building	High	Temporary noise and visual intrusion into its setting from construction activities.		Minor	Slight
26	Dunkeld and Birnam Station including Footbridge	Category A Listed Building	High	Accidental damage to architectural details and features, a key characteristic of this cultural heritage resource, including as a result of vibration.		Major	**Very Large**
				access option 1	Removal of elements within, and changes to setting affecting a key characteristic of this cultural heritage resource, reinforcement of the existing severance of the station and Birnam, restrictions to access limiting the use of the building, physical impacts to the platforms, and noise and visual intrusion associated with the presence and operation of construction plant.	Major	**Very Large**

Asset No	Asset Name	Designation	Value (sensitivity)	Impact Description		Magnitude	Significance
				access option 2	Removal of elements within, and changes to, setting affecting a key characteristic of this cultural heritage resource, reinforcement of the existing severance of the station and Birnam, restrictions to the access limiting the use of the building, change to the setting due to new temporary pedestrian footbridge and introduction of noise and visual intrusion associated with the presence and operation of construction plant.	Major	**Very Large**
				access option 3	Removal of elements within, and changes to, setting affecting a key characteristic of this cultural heritage resource, reinforcement of the existing severance of the station and Birnam, restrictions to the access limiting the use of the building, physical impacts to the platforms, change to the setting due to new temporary pedestrian footbridge and introduction of noise and visual intrusion associated with the presence and operation of construction plant.	Major	**Very Large**
				access option 4	Removal of elements within, and changes to, setting affecting a key characteristic of this cultural heritage resource, reinforcement of the existing severance of the station and Birnam, restrictions to the access limiting the use of the building, and introduction of noise and visual intrusion associated with the presence and operation of construction plant.	Major	**Large**
				access option 5	Removal of elements within, and changes to, setting affecting a key characteristic of this cultural heritage resource, reinforcement of the existing severance of the station and Birnam, restrictions to the access limiting the use of the building, change to the setting due to new temporary pedestrian footbridge and introduction of noise and visual intrusion associated with the presence and operation of construction plant.	Major	**Very Large**

Asset No	Asset Name	Designation	Value (sensitivity)	Impact Description		Magnitude	Significance
27	Dunsville, Gladstone Terrace, Birnam	Category C Listed Building	High	Temporary noise and visual intrusion into its setting from construction activities.		Minor	Slight
28	Craigielea, Gladstone Terrace, Birnam	Category C Listed Building	High	Temporary noise and visual intrusion into its setting from construction activities.		Minor	Slight
31	8 and 9 Birnam Terrace, Birnam	Category C Listed Building	High	Temporary noise and visual intrusion into its setting from construction activities.		Minor	Slight
32	Merryburn Hotel, Station Road, Birnam	Category C Listed Building	High	Temporary noise and visual intrusion into its setting from construction activities.		Minor	Slight
34	6 and 7 Birnam Terrace, Birnam	Category C Listed Building	High	Temporary noise and visual intrusion into its setting from construction activities.		Minor	Slight
35	4 and 5 Birnam Terrace, Birnam	Category C Listed Building	High	Temporary noise and visual intrusion into its setting from construction activities.		Minor	Slight
36	2 and 3 Birnam Terrace, Birnam	Category C Listed Building	High	Temporary noise and visual intrusion into its setting from construction activities.		Minor	Slight
37	1 Birnam Terrace, Birnam	Category C Listed Building	High	Temporary noise and visual intrusion into its setting from construction activities.		Minor	Slight
44	Birnam Conservation Area	Conservation Area	Medium	access options 1 and 3	Removal of elements within the Conservation Area and changes to character, reinforcement of the existing severance of the Conservation Area and introduction of noise and visual intrusion from construction traffic.	Moderate	**Moderate**
				access options 2, 4 and 5	Change of character, reinforcement of the existing severance of the Conservation Area and introduction of noise and visual intrusion from construction traffic.	Minor	Slight
56	Java House, Birnam	Category C Listed Building	High	Temporary visual intrusion into its setting from construction activities.		Negligible	Slight
497	Birnam War Memorial	None	Low	Changes to setting, affecting a key characteristic of this cultural heritage resource.		Negligible	Neutral

Asset No	Asset Name	Designation	Value (sensitivity)	Impact Description	Magnitude	Significance
HLT 14	Murthly Castle	Listed on the Inventory of Gardens and Designed Landscapes	High	Removal of an area of the Inventory garden and designed landscape, possible damage to the Cedar Avenue, change the alignment of the western drive and reinforcing severance of the cultural heritage resource to the west.	Moderate	**Large**

Table 14.9: Summary of Potential Operational Impacts and Effects – Option ST2A

Asset No	Asset Name	Designation	Value (sensitivity)	Impact Description		Magnitude	Significance
14	Craigmore House, Birnam	Category B Listed Building	High	Changes to setting.		Minor	Slight
15	Oakbank House, Birnam	Category C Listed Building	High	Changes to setting.		Minor	Slight
16	Dunkeld and Birnam Station Signal Box	Category B Listed Building	High	Changes to setting, affecting a key characteristic of this cultural heritage resource.		Minor	Slight Beneficial
17	Elsey Cottage, Birnam	Category C Listed Building	High	Changes to setting.		Minor	Slight
18	Birnam Bank Cottage, Birnam	Category C Listed Building	High	Changes to setting.		Minor	Slight
19	The Lodge, Birnam	Category B Listed Building	High	Changes to setting.		Minor	Slight
22	Birnam Bank House, Birnam	Category C Listed Building	High	Changes to setting.		Minor	Slight
				Permanent loss of part of the boundary wall and garden, not affecting key characteristics.		Negligible	Slight
26	Dunkeld and Birnam Station including Footbridge	Category A Listed Building	High	access options 1 and 3	Permanent changes to setting resulting from loss of forecourt, a key characteristic of this cultural heritage resource, the continued presence of extension to Platform 1 (southbound) and Platform 2 (northbound) and the replacement Highland Main Line railway bridge over Inchewan Burn.	Moderate	**Large**
				access options 2, 4 and 5	Permanent changes to setting, affecting a key characteristic of this cultural heritage resource, resulting from loss of the forecourt.	Moderate	**Moderate**
				Reinstatement of the physical and historical link with Birnam and public forecourt, a key characteristic of this cultural heritage resource, and improved access providing the opportunity for sustainable re-use.		Moderate	**Large Beneficial**

Asset No	Asset Name	Designation	Value (sensitivity)	Impact Description		Magnitude	Significance
44	Birnam Conservation Area	Conservation Area	Medium	access options 1 and 3	Permanent changes to character, loss of elements within the Conservation Area and reinforcement of the existing severance.	Moderate	**Moderate**
				access options 2, 4 and 5	Changes to the character of the Conservation Area and reinforcement of existing severance.	Minor	Slight
497	Birnam War Memorial	None	Low	Changes to setting.		Negligible	Neutral
HLT 14	Murthly Castle	Listed on the Inventory of Gardens and Designed Landscapes	High	Permanent changes to land-use of an area of the Inventory garden and designed landscape and reinforcing severance of the cultural heritage resource to the west.		Moderate	**Large**

Impacts and Effects Specific to Option ST2B

14.4.62 This section provides details on the potential impacts and effects which are specific to Option ST2B during construction and operation. These potential impacts and effects are presented in Tables 14.10 and 14.11 and are described in the following paragraphs.

Construction

14.4.63 The impact on Dunkeld and Birnam Station including Footbridge (Asset 26) potentially resulting from vibration associated with the construction of Option ST2B and either of the five access options is the same as that identified in paragraph 14.4.31. This potential impact has been assessed to be of major magnitude and a potential effect of Very Large significance.

14.4.64 Construction of Option ST2B along with access option 1 would result in the potential impact on Dunkeld and Birnam Station including Footbridge (Asset 26), described in paragraphs 14.4.32 and 14.4.33. This potential impact has been assessed to be of major magnitude and a potential effect of Very Large significance.

14.4.65 Construction of Option ST2B along with access option 3 would result in the changes to Dunkeld and Birnam Station including Footbridge (Asset 26), described in paragraphs 14.4.32, 14.4.33 and 14.4.34. The potential impact of these changes has been assessed to be of major magnitude and a potential effect of Very Large significance.

14.4.66 Construction of Option ST2B along with access option 2 would result in the changes to Dunkeld and Birnam Station including Footbridge (Asset 26), described in paragraphs 14.4.32 and 14.4.35. The potential impact of these changes has been assessed to be of major magnitude and a potential effect of Very Large significance.

14.4.67 Construction of Option ST2B along with access option 4 would result in the changes to Dunkeld and Birnam Station including Footbridge (Asset 26), described in paragraphs 14.4.32 and 14.4.36. The potential impact of these changes has been assessed to be of major magnitude and a potential effect of Large significance.

14.4.68 Construction of Option ST2B along with access option 5 would result in the changes to Dunkeld and Birnam Station including Footbridge (Asset 26), described in paragraphs 14.4.32 and 14.4.37. The potential impact of these changes has been assessed to be of major magnitude and a potential effect of Very Large significance.

14.4.69 Construction of Option ST2B including the new access road connecting to the western drive of Murthly Castle, Birnam Junction and two SuDS ponds, would result in land-take from Murthly Castle (HLT 14) an Inventory garden and designed landscape. While construction activities would reinforce the existing severance of the western end of HLT 14 and Birnam, once connected by a riverside drive running between Birnam to Victoria Bridge at Gellyburn, and the majority of the designed landscape to the east, the physical connection to Birnam and the route of the former riverside drive would be maintained. Although the Cedar Avenue, a feature of the western drive, would be retained, there is the possibility of accidental damage to it resulting from construction activities. These activities would also partially remove any surviving fabric and change the alignment of the western drive. While the Cedar Avenue and western drive are identified as a special feature of HLT 14, the key landscape features and remaining special features identified in the Inventory of Gardens and Designed Landscapes and summarised in paragraphs 14.3.48 and 14.3.49, would not be affected. This potential impact has been assessed to be of moderate magnitude and a potential effect of Large significance.

14.4.70 Construction of Option ST2B along with access option 1 or access option 3 would result in the changes to Birnam Conservation Area (Asset 44) described in paragraphs 14.4.40 and 14.4.41. The potential impact of these changes has been assessed to be of moderate magnitude and a potential effect of Moderate significance.

14.4.71 Construction of Option ST2B along with access option 2 or access option 4 would result in changes to Birnam Conservation Area (Asset 44) described in paragraphs 14.4.40, 14.4.42 and 14.4.43. The potential impact of these changes has been assessed to be of minor magnitude and a potential effect of Slight significance.

14.4.72 Construction of Option ST2B along with access option 5 would result in changes to Birnam Conservation Area (Asset 44) described in paragraphs 14.4.40 and 14.4.44. The potential impact of these changes has been assessed to be of minor magnitude and a potential effect of Slight significance.

14.4.73 Construction of Option ST2B including ground preparation for the new access road would remove a key characteristic of Dalpowie Lodge (site of) (Asset 5) comprising any surviving physical remains of the enclosures and gardens (refer to paragraph 14.3.12), to the north of the ancillary buildings depicted on early Ordnance Survey mapping. This potential impact has been assessed to be of minor magnitude and a potential effect of Slight significance.

14.4.74 For seven Category B and C Listed buildings (Assets 14, 15, 17, 18, 19, 22 and 56), potential impacts are the same as those for Option ST2A and are described in paragraphs 14.4.45, 14.4.46 and 14.48. For Assets 14, 15, 17, 18, 19 and 22 these potential impacts have been assessed to be of minor magnitude and a potential effect of Slight significance. For Asset 56 this potential impact has been assessed to be of negligible magnitude and a potential effect of Slight significance.

14.4.75 While construction activities associated with improvements to Station Road would be visible and audible from Merryburn Hotel, Station Road, Birnam (Asset 32; a Category C Listed Building), this would not affect this cultural heritage resource's key characteristics which are its architectural detail and features and our understanding of it as a roadside hotel. This potential impact has been assessed to be of negligible magnitude and a potential effect of Slight significance.

14.4.76 For Birnam War Memorial (Asset 497), potential impacts are the same as those for Option ST2A and ST2D and are described in paragraphs 14.4.49. This potential impact has been assessed to be of negligible magnitude and a potential effect of Neutral significance.

Operation

14.4.77 The adverse impact on Dunkeld and Birnam Station including Footbridge (Asset 26) for Option ST2B and access option 1 and access option 3 would be the same as for Option ST2A and access option 1 and access option 3 described and assessed in paragraph 14.4.50 and 14.4.51. This potential impact has been assessed to be of moderate magnitude and a potential effect of Large significance.

14.4.78 The adverse impact on Dunkeld and Birnam Station including Footbridge (Asset 26) for Option ST2B with access option 2, access option 4 or access option 5 would be the same as for Option ST2A and access option 2, access option 4 or access option 5 described and assessed in paragraph 14.4.50 and 14.4.52. This potential impact has been assessed to be of moderate magnitude and a potential effect of Moderate significance.

14.4.79 The beneficial impact on Dunkeld and Birnam Station including Footbridge (Asset 26) for Option ST2B and all the access options is the same as those for Option ST2A and described in paragraph 14.4.53. This potential impact has been assessed to be of moderate magnitude and a potential effect of Large beneficial significance.

14.4.80 Potential impact resulting from the removal of historic landscape elements, including small areas of woodland, and changes in land-use during construction would continue due to the presence of Option ST2B within Murthly Castle (HLT 14) Inventory garden and designed landscape. The presence of the proposed route option would permanently reinforce the existing severance of the western end of HLT 14 from the designed landscape to the east and its historical connection to Birnam. This would affect the integrity of the western drive which has been identified as a special feature of the Inventory garden and designed landscape (refer to paragraphs 14.3.48 and 14.3.49). This potential impact has been assessed to be of moderate magnitude and a potential effect of Large significance.

14.4.81 Operation of Option ST2B along with access option 1 or access option 3 would result in the changes to Birnam Conservation Area (Asset 44) described in paragraphs 14.4.55 and 14.4.56. The potential impact of these changes has been assessed to be of moderate magnitude and a potential effect of Moderate significance.

14.4.82 Operation of Option ST2B along with access option 2, access option 4 or access option 5 would result in changes to Birnam Conservation Area (Asset 44) described in paragraphs 14.4.55 and 14.4.57. The potential impact of these changes has been assessed to be of minor magnitude and a potential effect of Slight significance.

14.4.83 Operation of Option ST2B along with any of the access options would result in impact on the setting of six Category B and C Listed Buildings (Assets 14, 15, 17, 18, 19 and 22) described in paragraph 14.4.58. This potential impact has been assessed to be of minor magnitude and a potential effect of Slight significance.

14.4.84 For Dunkeld and Birnam Station Signal Box (Asset 16) impact is the same as those for Option ST2A and are described in paragraph 14.4.59. This potential impact has been assessed to be of minor magnitude and a potential effect of Slight beneficial significance.

14.4.85 Operation of Option ST2B along with any of the access options would result in impact on Birnam Bank House, Birnam (Asset 22) and are described in paragraph 14.4.60. This potential impact has been assessed to be of negligible magnitude and a potential effect of Slight significance.

14.4.86 For Birnam War Memorial (Asset 497) the impact is the same as described in paragraph 14.4.61. This potential impact has been assessed to be of negligible magnitude and a potential effect of Neutral significance.

Table 14.10: Summary of Potential Construction Impacts and Effects – Option ST2B

Asset No	Asset Name	Designation	Value (sensitivity)	Impact Description		Magnitude	Significance
5	Dalpowie Lodge (site of)	None	Medium	Removal of any physical remains, a key characteristic of this cultural heritage resource, present within the footprint of the proposed route option.		Minor	Slight
14	Craigmore House, Birnam	Category B Listed Building	High	Temporary noise and visual intrusion into its setting from construction activities.		Minor	Slight
15	Oakbank House, Birnam	Category C Listed Building	High	Temporary noise and visual intrusion into its setting from construction activities.		Minor	Slight
17	Elsey Cottage, Birnam	Category C Listed Building	High	Temporary noise and visual intrusion into its setting from construction activities.		Minor	Slight
18	Birnam Bank Cottage, Birnam	Category C Listed Building	High	Temporary noise and visual intrusion into its setting from construction activities.		Minor	Slight
19	The Lodge, Birnam	Category B Listed Building	High	Temporary noise and visual intrusion into its setting from construction activities.		Minor	Slight
22	Birnam Bank House, Birnam	Category C Listed Building	High	Temporary noise and visual intrusion into its setting from construction activities.		Minor	Slight
				Removal of part of the boundary wall and garden.		Minor	Slight
26	Dunkeld and Birnam Station including Footbridge	Category A Listed Building	High	Accidental damage to architectural details and features, a key characteristic of this cultural heritage resource, including as a result of vibration.		Major	**Very Large**
				access option 1	Removal of elements within, and changes to, setting affecting a key characteristic of this cultural heritage resource, reinforcement of the existing severance of the station and Birnam, restrictions to the access limiting the use of the building, physical impacts to the platforms, and introduction of noise and visual intrusion associated with the presence and operation of construction plant.	Major	**Very Large**
				access option 2	Removal of elements within, and changes to, setting, affecting a key characteristic of this cultural heritage resource, reinforcement of the existing severance of the station and Birnam, restrictions to the access limiting the	Major	**Very Large**

Asset No	Asset Name	Designation	Value (sensitivity)	Impact Description		Magnitude	Significance
					use of the building, change to the setting due to new temporary pedestrian footbridge and introduction of noise and visual intrusion associated with the presence and operation of construction plant.		
				access option 3	Removal of elements within, and changes to, setting, affecting a key characteristic of this cultural heritage resource, reinforcement of the existing severance of the station and Birnam, restrictions to the access limiting the use of the building, physical impacts to the platforms, change to the setting due to new temporary pedestrian footbridge and introduction of noise and visual intrusion associated with the presence and operation of construction plant.	Major	**Very Large**
				access option 4	Removal of elements within, and changes to, setting, a key characteristic of this cultural heritage resource, reinforcement of the existing severance of the station and Birnam, restrictions to the access limiting the use of the building, and introduction of noise and visual intrusion associated with the presence and operation of construction plant.	Major	**Large**
				access option 5	Removal of elements within, and changes to, setting, affecting a key characteristic of this cultural heritage resource, reinforcement of the existing severance of the station and Birnam, restrictions to the access limiting the use of the building, change to the setting due to new temporary pedestrian footbridge and introduction of noise and visual intrusion associated with the presence and operation of construction plant.	Major	**Very Large**
32	Merryburn Hotel, Station Road, Birnam	Category C Listed Building	High	Temporary noise and visual intrusion into its setting, a key characteristic of this cultural heritage resource, from construction activities.		Negligible	Slight

Asset No	Asset Name	Designation	Value (sensitivity)	Impact Description		Magnitude	Significance
44	Birnam Conservation Area	Conservation Area	Medium	access options 1 and 3	Removal of elements within the Conservation Area and changes to character, reinforcement of the existing severance of the Conservation Area and introduction of noise and visual intrusion from construction traffic.	Moderate	**Moderate**
				access options 2, 4 and 5	Change of character, reinforcement of the existing severance of the Conservation Area and introduction of noise and visual intrusion from construction traffic.	Minor	Slight
56	Java House, Birnam	Category C Listed Building	High	Temporary visual intrusion into its setting from construction activities.		Negligible	Slight
497	Birnam War Memorial	None	Low	Changes to setting, affecting a key characteristic of this cultural heritage resource.		Negligible	Neutral
HLT 14	Murthly Castle	Listed on the Inventory of Gardens and Designed Landscapes	High	Removal of an area of the Inventory garden and designed landscape, possible damage to the Cedar Avenue change the alignment of the western drive and reinforcing the severance of the cultural heritage resource to the west.		Moderate	**Large**

Table 14.11: Summary of Potential Operational Impacts and Effects - Option ST2B

Asset No	Asset Name	Designation	Value (sensitivity)	Impact Description	Magnitude	Significance
14	Craigmore House, Birnam	Category B Listed Building	High	Changes to setting.	Minor	Slight
15	Oakbank House, Birnam	Category C Listed Building	High	Changes to setting.	Minor	Slight
16	Dunkeld and Birnam Station Signal Box	Category B Listed Building	High	Changes to setting, affecting a key characteristic of this cultural heritage resource.	Minor	Slight Beneficial
17	Elsey Cottage, Birnam	Category C Listed Building	High	Changes to setting.	Minor	Slight
18	Birnam Bank Cottage, Birnam	Category C Listed Building	High	Changes to setting.	Minor	Slight
19	The Lodge, Birnam	Category B Listed Building	High	Changes to setting.	Minor	Slight

Asset No	Asset Name	Designation	Value (sensitivity)	Impact Description		Magnitude	Significance
22	Birnam Bank House, Birnam	Category C Listed Building	High	Changes to setting.		Minor	Slight
				Permanent loss of part of the boundary wall and garden, not affecting key characteristics.		Negligible	Slight
26	Dunkeld and Birnam Station including Footbridge	Category A Listed Building	High	access options 1 and 3	Permanent changes to setting, a key characteristic of this cultural heritage resource, resulting from loss of forecourt, the continued presence of extension to Platform 1 (southbound) and Platform 2 (northbound) and the replacement Highland Main Line railway bridge over Inchewan Burn.	Moderate	**Large**
				access options 2, 4 and 5	Permanent changes to setting, a key characteristic of this cultural heritage resource, resulting from loss of the forecourt.	Moderate	**Moderate**
				Reinstatement of the physical and historical link with Birnam and public forecourt, a key characteristic of this cultural heritage resource, and improved access providing the opportunity for sustainable re-use.		Moderate	**Large Beneficial**
44	Birnam Conservation Area	Conservation Area	Medium	access options 1 and 3	Permanent changes to character, loss of elements within the Conservation Area and reinforcement of the existing severance.	Moderate	**Moderate**
				access options 2, 4 and 5	Changes to the character of the Conservation Area and reinforcement of the existing severance.	Minor	Slight
497	Birnam War Memorial	None	Low	Changes to setting, affecting a key characteristic of this cultural heritage resource.		Negligible	Neutral
HLT 14	Murthly Castle	Listed on the Inventory of Gardens and Designed Landscapes	High	Permanent changes to land-use of an area of the Inventory garden and designed landscape and reinforcing severance of the cultural heritage resource to the west.		Moderate	**Large**

Impacts and Effects Specific to Option ST2C

14.4.87 This section provides details on the potential impacts and effects which are specific to Option ST2C during construction and operation. These potential impacts and effects are presented in Tables 14.12 and 14.13 and are described in the following paragraphs.

Construction

14.4.88 Option ST2C and access option 2 would require construction in close proximity to Dunkeld and Birnam Station including Footbridge (Asset 26), including sheet piling for the pedestrian underpass. While the vibration assessment for the sheet piling identified no potential significant impacts on the station building, canopy, and footbridge, the vibration assessment did identify the potential for damage to the rear platform wall (refer to Volume 1, Part 3 – Environmental Assessment (Chapter 16: Noise and Vibration, paragraphs 16.4.32 to 16.4.36)) which may form part of the curtilage listing of Asset 26 (see paragraph 14.2.3). Should accidental damage arise from the operation of construction plant in close proximity to Dunkeld and Birnam Station including Footbridge (Asset 26), on a worst-case basis, this potential impact has been assessed to be of major magnitude and a potential effect of Very Large significance.

14.4.89 During the construction of Option ST2C and access option 2 in addition to the changes identified in paragraph 14.4.32 provision of a new temporary pedestrian footbridge would introduce a new element into the setting of Dunkeld and Birnam Station including Footbridge (Asset 26) diminishing the relationship between it and other elements of railway infrastructure which is a key characteristic of Asset 26 (refer to paragraph 14.3.27). The potential impact on Dunkeld and Birnam Station including Footbridge (Asset 26) resulting from the provision of this temporary pedestrian footbridge and from the changes identified in paragraph 14.4.32 have been assessed to be of major magnitude and a potential effect of Very Large significance.

14.4.90 The potential impact on Murthly Castle (HLT 14) is the same as for Options ST2B and ST2D and are described in paragraph 14.4.69. This potential impact has been assessed to be of moderate magnitude and a potential of Large significance.

14.4.91 For Dalpowie Lodge (site of) (Asset 5) the potential impact is the same as for Option ST2B and ST2D and is described in paragraph 14.4.73. This potential impact has been assessed to be of minor magnitude and a potential effect of Slight significance.

14.4.92 Construction of Option ST2C would change the character of Birnam Conservation Area (Asset 44) through removal of small areas of existing roadside tree planting and remove existing mature woodland to the west of Inchewan Burn for the construction of a SuDS feature. Construction activities would introduce new sources of noise and visual intrusion into Birnam Conservation Area (Asset 44) and the setting of 13 Category B and C Listed buildings within the Conservation Area (Assets 14, 15, 19, 22, 25, 27, 28, 31, 32, 34, 35, 36 and 37). Views to the north-east towards the construction activities from Assets 17 and 18 would be screened by existing buildings. The setting of Assets 14, 15, 19 and 22 and the character of the Conservation Area to the south-west of the Highland Main Line railway, comprises their quiet secluded location, wooded gardens and the buildings relationship with each other forming a discreet group. While construction activities would reinforce the severance of Birnam Conservation Area, the key characteristics of these cultural heritage resources comprising their architectural detail and features, large secluded wooded gardens and relationship with each other (refer to paragraph 14.3.32) would not be affected. The potential impacts on Birnam Conservation Area (Asset 44) to the south-west of the Highland Main Line railway and four Category B and C Listed Buildings within it (Assets 14, 15, 19 and 22) have been assessed to be of minor magnitude and a potential effect of Slight significance.

14.4.93 In addition to the potential impacts identified in paragraph 14.4.92 the temporary pedestrian access would be partially located within Birnam Conservation Area (Asset 44) during construction of Option

ST2C with access option 2. The potential impact resulting from this change has been assessed to be of minor magnitude and a potential effect of Slight significance.

14.4.94 Assets 25, 27, 28, 31, 34, 35, 36 and 37 are mid-Victorian terraced houses on Birnam Terrace and Gladstone Terrace, and Asset 32 is a hotel on Station Road. Their setting comprises their roadside location, relationship to each other as terraced houses and Birnam Conservation Area (Asset 44) to the north of the Highland Main Line railway. The character of the Conservation Area to the north of the Highland Main Line railway comprises a small settlement of well-designed mostly mid-Victorian houses and commercial buildings illustrating the growth of Birnam following the introduction of the railway. Construction activities for the station car park and a SuDS pond may be visible from the rear of Assets 25, 27, 28, 31, 32, 34, 35, 36 and 37, and from limited views from the Conservation Area, and these activities would introduce new sources of noise intrusion into their setting. However, the key characteristics of Assets 25, 27, 28, 31, 32, 34, 35, 36 and 37 which are their architectural detail and features, our understanding of them as part of the early development of Birnam and their relationship to each another (refer to paragraph 14.3.33), and the character of the Conservation Area to the north of the Highland Main Line railway would not be affected. The potential impacts on Birnam Conservation Area (Asset 44) to the north-west of the Highland Main Line railway and nine Category B and C Listed Buildings within it (Assets 25, 27, 28, 31, 32, 34, 35, 36 and 37) have been assessed to be of minor magnitude and a potential effect of Slight significance.

14.4.95 Construction activities for Dunkeld Junction would remove part of the knoll on which Birnam War Memorial (Asset 497) sits, forming the public open space and woodland surrounding it. Construction activities would also introduce new sources of noise and visual intrusion into its setting. However, there would be no physical impact on the architectural detail or features of Asset 497, and views to the north in parallel with the River Tay crossing and its commemorative function, which are key characteristics of this cultural heritage resource (refer to paragraph 14.3.39), would be maintained. This potential impact has been assessed to be of minor magnitude and a potential effect of Slight significance.

Operation

14.4.96 Changes to the setting of Dunkeld and Birnam Station including Footbridge (Asset 26), including the loss of the public forecourt, a key characteristics of this cultural heritage resource (refer to paragraph 14.3.27), and the visible presence of the carriageway and associated infrastructure, would continue into operation. This potential impact has been assessed to be of moderate magnitude and a potential effect of Large significance.

14.4.97 The pedestrian underpass would also improve the physical connection between Dunkeld and Birnam Station including Footbridge (Asset 26) and Birnam. In addition, the replacement car park and underpass would provide an opportunity for the re-use of the building and an additional left-in left-out junction on the northbound carriageway would provide maintenance and emergency access to Dunkeld and Birnam Station. This potential impact has been assessed to be of minor magnitude and a potential effect of Slight beneficial significance.

14.4.98 The potential impact on Murthly Castle (HLT 14) is the same as for Options ST2B and ST2D and is described in paragraph 14.4.80. This potential impact has been assessed to be of moderate magnitude and a potential effect of Large significance.

14.4.99 The change in the character of Birnam Conservation Area (Asset 44) in the immediate vicinity of the SuDS feature west of Inchewan Burn would continue from construction into operation. While operation of this option would continue to reinforce the severance of Birnam Conservation Area (Asset 44) south-west of the Highland Main Line railway from Birnam, the sense of isolation as a discreet area of development within it, and the key characteristics of Assets 14, 15, 19 and 22, including their architectural detail and features, large secluded wooded gardens and relationship with each other (refer to paragraph 14.3.32), would not be affected. In addition, the operation of the station car park would

result in a new source of noise and visual intrusion within the setting of nine of the listed buildings (Assets 25, 27, 28, 31, 32, 34, 35, 36 and 37) which are located within Birnam Conservation Area (Asset 44) to the north of the Highland Main Line railway. While the operation of the station car park would introduce vehicle noise and movement into the setting of Assets 25, 27, 28, 31, 34, 35, 36, 37 and 44 these changes would not affect the understanding of them as part of the mid-Victorian development of Birnam and their relationship to one another, or the character of Birnam Conservation Area to the north of the Highland Main Line railway. The architectural detail and features which are a key characteristic of Assets 25, 27, 28, 31, 34, 35, 36 and 37 (refer to paragraph 14.3.32), would not be affected. The potential impacts on Birnam Conservation Area (Asset 44) and 13 Category B and C Listed Buildings within it (Assets 14, 15, 19, 22, 25, 27, 28, 31, 32, 34, 35, 36 and 37) have been assessed to be of negligible magnitude and a potential effect of Slight significance.

14.4.100 During operation traffic movement and traffic noise would be visible and audible from Dunkeld and Birnam Station Signal Box (Asset 16), a Category B Listed Building. However, the key characteristics of Asset 16 which are its architectural detail and features and the relationship between the adjacent Highland Main Line railway and Dunkeld and Birnam Station including Footbridge (Asset 26) (refer to paragraph 14.3.34) that contribute to the value (sensitivity) of Asset 16, would not be affected. This potential impact has therefore been assessed to be of negligible magnitude and a potential effect of Slight significance.

14.4.101 The changes to the setting of Birnam War Memorial (Asset 497) during construction, including changes to the surrounding public open space and woodland, a key characteristic of Asset 497, would continue into operation. However, retained woodland would filter views from the war memorial of Dunkeld Junction, and the maintained views to the north in parallel with the River Tay crossing and its commemorative function, which are key characteristics of Asset 497 (refer to paragraph 14.3.39), would not be affected. This potential impact has been assessed to be of minor magnitude and a potential effect of Slight significance.

Table 14.12: Summary of Potential Construction Impacts and Effects - Option ST2C

Asset No	Asset Name	Designation	Value (sensitivity)	Impact Description	Magnitude	Significance
5	Dalpowie Lodge (site of)	None	Medium	Removal of any physical remains, a key characteristic of this cultural heritage resource, present within the footprint of the proposed route option.	Minor	Slight
14	Craigmore House, Birnam	Category B Listed Building	High	Temporary noise and visual intrusion into its setting from construction activities.	Minor	Slight
15	Oakbank House, Birnam	Category C Listed Building	High	Temporary noise and visual intrusion into its setting from construction activities.	Minor	Slight
19	The Lodge, Birnam	Category B Listed Building	High	Temporary noise and visual intrusion into its setting from construction activities.	Minor	Slight
22	Birnam Bank House, Birnam	Category C Listed Building	High	Temporary noise and visual intrusion into its setting from construction activities.	Minor	Slight
25	Gladstone Terrace, Terrace Block House, Birnam	Category C Listed Building	High	Temporary noise and visual intrusion into its setting from construction activities.	Minor	Slight
26	Dunkeld and Birnam Station including Footbridge	Category A Listed Building	High	Accidental damage to architectural details and features, a key characteristic of this cultural heritage resource.	Major	**Very Large**
				Removal of elements within, and changes to, setting, affecting key characteristic of this cultural heritage resource, reinforcement of the existing separation between the station and Birnam, restrictions to the access limiting the use of the building, change to the setting due to new temporary pedestrian footbridge (access option 2) and introduction of noise and visual intrusion associated with the presence and operation of construction plant.	Major	**Very Large**
27	Dunsville, Gladstone Terrace, Birnam	Category C Listed Building	High	Temporary noise and visual intrusion into its setting from construction activities.	Minor	Slight
28	Craigielea, Gladstone Terrace, Birnam	Category C Listed Building	High	Temporary noise and visual intrusion into its setting from construction activities.	Minor	Slight
31	8 and 9 Birnam Terrace, Birnam	Category C Listed Building	High	Temporary noise and visual intrusion into its setting from construction activities.	Minor	Slight
32	Merryburn Hotel, Station Road, Birnam	Category C Listed Building	High	Temporary noise and visual intrusion into its setting from construction activities.	Minor	Slight
34	6 and 7 Birnam Terrace, Birnam	Category C Listed Building	High	Temporary noise and visual intrusion into its setting from construction activities.	Minor	Slight
35	4 and 5 Birnam Terrace, Birnam	Category C Listed Building	High	Temporary noise and visual intrusion into its setting from construction activities.	Minor	Slight

Asset No	Asset Name	Designation	Value (sensitivity)	Impact Description	Magnitude	Significance
36	2 and 3 Birnam Terrace, Birnam	Category C Listed Building	High	Temporary noise and visual intrusion into its setting from construction activities.	Minor	Slight
37	1 Birnam Terrace, Birnam	Category C Listed Building	High	Temporary noise and visual intrusion into its setting from construction activities.	Minor	Slight
44	Birnam Conservation Area	Conservation Area	Medium	Removal of an area of woodland and roadside planting, the presence of the temporary pedestrian footbridge (access option 2) partly within the Conservation Area and reinforcement of severance with the Birnam Conservation Area to the north-east of the Highland Main Line railway.	Minor	Slight
497	Birnam War Memorial	None	Low	Changes to setting, affecting a key characteristic of this cultural heritage resource.	Minor	Slight
HLT 14	Murthly Castle	Listed on the Inventory of Gardens and Designed Landscapes	High	Removal of an area of the Inventory garden and designed landscape, possible damage to the Cedar Avenue, change the alignment of the western drive and reinforcing severance of the cultural heritage resource to the west.	Moderate	**Large**

Table 14.13: Summary of Potential Operation Impacts and Effects - Option ST2C

Asset No	Asset Name	Designation	Value (sensitivity)	Impact Description	Magnitude	Significance
14	Craigmore House, Birnam	Category B Listed Building	High	Changes to setting.	Negligible	Slight
15	Oakbank House, Birnam	Category C Listed Building	High	Changes to setting.	Negligible	Slight
16	Dunkeld and Birnam Station Signal Box	Category B Listed Building	High	Changes to setting.	Negligible	Slight
19	The Lodge, Birnam	Category B Listed Building	High	Changes to setting.	Negligible	Slight
22	Birnam Bank House, Birnam	Category C Listed Building	High	Changes to setting.	Negligible	Slight
25	Gladstone Terrace, Terrace Block House, Birnam	Category C Listed Building	High	Changes to setting.	Negligible	Slight

Asset No	Asset Name	Designation	Value (sensitivity)	Impact Description	Magnitude	Significance
26	Dunkeld and Birnam Station including Footbridge	Category A Listed Building	High	Permanent changes to setting, resulting from loss of forecourt, a key characteristic of this cultural heritage resource, reinforcement of the existing separation between the station and Birnam, and visible presence of the carriageway and associated infrastructure.	Moderate	**Large**
				Partial reinstatement of the physical and historical link with Birnam and opportunities for sustainable re-use.	Minor	Slight beneficial
27	Dunsville, Gladstone Terrace, Birnam	Category C Listed Building	High	Changes to setting.	Negligible	Slight
28	Craigielea, Gladstone Terrace, Birnam	Category C Listed Building	High	Changes to setting.	Negligible	Slight
31	8 and 9 Birnam Terrace, Birnam	Category C Listed Building	High	Changes to setting.	Negligible	Slight
32	Merryburn Hotel, Station Road, Birnam	Category C Listed Building	High	Changes to setting.	Negligible	Slight
34	6 and 7 Birnam Terrace, Birnam	Category C Listed Building	High	Changes to setting.	Negligible	Slight
35	4 and 5 Birnam Terrace, Birnam	Category C Listed Building	High	Changes to setting.	Negligible	Slight
36	2 and 3 Birnam Terrace, Birnam	Category C Listed Building	High	Changes to setting.	Negligible	Slight
37	1 Birnam Terrace, Birnam	Category C Listed Building	High	Changes to setting.	Negligible	Slight
44	Birnam Conservation Area	Conservation Area	Medium	Changes to the character and permanent reinforcement of severance with the Birnam Conservation Area to the north-east of the Highland Main Line railway.	Negligible	Neutral
497	Birnam War Memorial	None	Low	Changes to setting, affecting a key characteristic of this cultural heritage resource.	Minor	Slight
HLT 14	Murthly Castle	Listed on the Inventory of Gardens and Designed Landscapes	High	Permanent changes to land-use of an area of the Inventory garden and designed landscape and reinforcing severance of the cultural heritage resource to the west.	Moderate	**Large**

Impacts and Effects Specific to Option ST2D

14.4.102 This section provides details on the potential impacts and effects which are specific to Option ST2D during construction and operation. These potential impacts and effects are presented in Tables 14.14 and 14.15 and are described in the following paragraphs.

Construction

14.4.103 The potential impact on Dunkeld and Birnam Station including Footbridge (Asset 26) resulting from accidental damage arising from the operation of construction plant in close proximity to Asset 26, including sheet piling for the pedestrian underpass, resulting from the construction of Option ST2D and access option 2 are the same as those identified in paragraph 14.4.88. This potential impact has been assessed to be of major magnitude and a potential effect of Very Large significance.

14.4.104 The potential impact on Dunkeld and Birnam Station including Footbridge (Asset 26) resulting from construction of Option ST2D and access option 2 would be as described and assessed in paragraphs 14.4.32 and 14.4.89. This potential impact has been assessed to be of major magnitude and a potential effect of Very Large significance.

14.4.105 The potential impact on Murthly Castle (HLT 14) is the same as for Options ST2B and ST2C and is described in paragraph 14.4.69. This potential impact has been assessed to be of moderate magnitude, and a potential effect of Large significance.

14.4.106 For Dalpowie Lodge (site of) (Asset 5) the potential impact is the same as for Option ST2B and ST2C and is described in paragraph 14.4.73. This potential impact has been assessed to be of minor magnitude and a potential effect of Slight significance.

14.4.107 The potential impacts for 13 Category B and C Listed buildings (Assets 14, 15, 19, 22, 25, 27, 28, 31, 32, 34, 35, 36 and 37) are the same as those for Option ST2C and are described in paragraphs 14.4.92 and 14.4.94. These potential impacts have been assessed to be of minor magnitude and a potential effect of Slight significance.

14.4.108 The potential impact for Birnam Conservation Area (Asset 44) for Option ST2D and access option 2 are the same as those for Option ST2C and are described in paragraphs 14.4.92 and 14.4.93. This potential impact has been assessed to be of minor magnitude and a potential effect of Slight significance.

14.4.109 For Birnam War Memorial (Asset 497) the potential impact is the same as those for Options ST2A and is described in paragraph 14.4.49. This potential impact has been assessed to be of negligible magnitude and a potential effect of Neutral significance.

Operation

14.4.110 Changes to the setting of Dunkeld and Birnam Station including Footbridge (Asset 26), including the loss of the public forecourt, a key characteristics of this cultural heritage resource (refer to paragraph 14.3.27), reinforcement of the existing separation between the station and Birnam, and the visible presence of the carriageway and associated infrastructure, would continue into operation. This potential impact has been assessed to be of moderate magnitude and a potential effect of Large significance.

14.4.111 The pedestrian underpass would also improve the physical connection between Dunkeld and Birnam Station including Footbridge (Asset 26) and Birnam. In addition, the replacement car park and underpass would provide an opportunity for the re-use of the building and an additional left-in left-out junction on the northbound carriageway would provide maintenance and emergency access to Dunkeld and Birnam Station. This potential impact has been assessed to be of minor magnitude and a potential effect of Slight beneficial significance.

14.4.112 The potential impact on Murthly Castle (HLT 14) is the same as for Options ST2B and ST2C and is described in paragraph 14.4.80. This potential impact has been assessed to be of moderate magnitude and a potential effect of Large significance.

14.4.113 The potential impacts for 13 Category B and C Listed buildings (Assets 14, 15, 19, 22, 25, 27, 28, 31, 32, 34, 35, 36 and 37) are the same as those for Option ST2C and are described in paragraph 14.4.99. These potential impacts have been assessed to be of negligible magnitude and a potential effect of Slight significance.

14.4.114 For Dunkeld and Birnam Station Signal Box (Asset 16) the potential impact is the same as for Option ST2C and is described in paragraph 14.4.100 This potential impact has been assessed to be of negligible magnitude and a potential effect of Slight significance.

14.4.115 The potential impact of the changes to the character of Birnam Conservation Area (Asset 44) identified in paragraph 14.4.99 would continue into operation. This potential impact has been assessed to be of negligible magnitude and a potential effect of Neutral significance.

14.4.116 For Birnam War Memorial (Asset 497), the potential impact is the same as for Options ST2A and ST2B and is described in paragraph 14.4.61. This potential impact has been assessed to be of negligible magnitude and a potential effect of Neutral significance.

Table 14.14: Summary of Potential Construction Impacts and Effects - Option ST2D

Asset No	Asset Name	Designation	Value (sensitivity)	Impact Description	Magnitude	Significance
5	Dalpowie Lodge (site of)	None	Medium	Removal of any physical remains, a key characteristic of this cultural heritage resource, present within the footprint of the proposed route option.	Minor	Slight
14	Craigmore House, Birnam	Category B Listed Building	High	Temporary noise and visual intrusion into its setting from construction activities.	Minor	Slight
15	Oakbank House, Birnam	Category C Listed Building	High	Temporary noise and visual intrusion into its setting from construction activities.	Minor	Slight
19	The Lodge, Birnam	Category B Listed Building	High	Temporary noise and visual intrusion into its setting from construction activities.	Minor	Slight
22	Birnam Bank House, Birnam	Category C Listed Building	High	Temporary noise and visual intrusion into its setting from construction activities.	Minor	Slight
25	Gladstone Terrace, Terrace Block House, Birnam	Category C Listed Building	High	Temporary noise and visual intrusion into its setting from construction activities.	Minor	Slight
26	Dunkeld and Birnam Station including Footbridge	Category A Listed Building	High	Accidental damage to architectural details and features, a key characteristic of this cultural heritage resource.	Major	**Very Large**
				Removal of elements within, and changes to, setting, affecting key characteristics of this cultural heritage resource, reinforcement of the existing separation between the station and Birnam, restrictions to the access limiting the use of the building, change to the setting due to new temporary pedestrian footbridge (access option 2) and introduction of noise and visual intrusion associated with the presence and operation of construction plant.	Major	**Very Large**
27	Dunsville, Gladstone Terrace, Birnam	Category C Listed Building	High	Temporary noise and visual intrusion into its setting from construction activities.	Minor	Slight
28	Craigielea, Gladstone Terrace, Birnam	Category C Listed Building	High	Temporary noise and visual intrusion into its setting from construction activities.	Minor	Slight

Asset No	Asset Name	Designation	Value (sensitivity)	Impact Description	Magnitude	Significance
31	8 and 9 Birnam Terrace, Birnam	Category C Listed Building	High	Temporary noise and visual intrusion into its setting from construction activities.	Minor	Slight
32	Merryburn Hotel, Station Road, Birnam	Category C Listed Building	High	Temporary noise and visual intrusion into its setting from construction activities.	Minor	Slight
34	6 and 7 Birnam Terrace, Birnam	Category C Listed Building	High	Temporary noise and visual intrusion into its setting from construction activities.	Minor	Slight
35	4 and 5 Birnam Terrace, Birnam	Category C Listed Building	High	Temporary noise and visual intrusion into its setting from construction activities.	Minor	Slight
36	2 and 3 Birnam Terrace, Birnam	Category C Listed Building	High	Temporary noise and visual intrusion into its setting from construction activities.	Minor	Slight
37	1 Birnam Terrace, Birnam	Category C Listed Building	High	Temporary noise and visual intrusion into its setting construction activities.	Minor	Slight
44	Birnam Conservation Area	Conservation Area	Medium	Removal of an area of woodland and roadside planting, the presence of the temporary pedestrian footbridge (access option 2) partly within the Conservation Area and reinforcement of severance with the Birnam Conservation Area to the north-east of the Highland Main Line railway.	Minor	Slight
497	Birnam War Memorial	None	Low	Changes to setting, affecting a key characteristic of this cultural heritage resource.	Negligible	Neutral
HLT 14	Murthly Castle	Listed on the Inventory of Gardens and Designed Landscapes	High	Removal of an area of the Inventory garden and designed landscape, possible damage to the Cedar Avenue, change the alignment of the western drive and reinforcing severance of the cultural heritage resource to the west.	Moderate	**Large**

Table 14.15: Summary of Potential Operation Impacts and Effects - Option ST2D

Asset No	Asset Name	Designation	Value (sensitivity)	Impact Description	Magnitude	Significance
14	Craigmore House, Birnam	Category B Listed Building	High	Changes to setting.	Negligible	Slight
15	Oakbank House, Birnam	Category C Listed Building	High	Changes to setting.	Negligible	Slight
16	Dunkeld and Birnam Station Signal Box	Category B Listed Building	High	Changes to setting.	Negligible	Slight
19	The Lodge, Birnam	Category B Listed Building	High	Changes to setting.	Negligible	Slight
22	Birnam Bank House, Birnam	Category C Listed Building	High	Changes to setting.	Negligible	Slight
25	Gladstone Terrace, Terrace Block House, Birnam	Category C Listed Building	High	Changes to setting.	Negligible	Slight
26	Dunkeld and Birnam Station including Footbridge	Category A Listed Building	High	Permanent changes to setting resulting from loss of forecourt, a key characteristic of this cultural heritage resource, and presence of the carriageway and associated infrastructure. Reinforcement of the existing separation between the station and Birnam.	Moderate	**Large**
				Partial reinstatement of the physical and historical link with Birnam and opportunities for sustainable re-use.	Minor	Slight beneficial
27	Dunsville, Gladstone Terrace, Birnam	Category C Listed Building	High	Changes to setting.	Negligible	Slight
28	Craigielea, Gladstone Terrace, Birnam	Category C Listed Building	High	Changes to setting.	Negligible	Slight
31	8 and 9 Birnam Terrace, Birnam	Category C Listed Building	High	Changes to setting.	Negligible	Slight
32	Merryburn Hotel, Station Road, Birnam	Category C Listed Building	High	Changes to setting.	Negligible	Slight
34	6 and 7 Birnam Terrace, Birnam	Category C Listed Building	High	Changes to setting.	Negligible	Slight
35	4 and 5 Birnam Terrace, Birnam	Category C Listed Building	High	Changes to setting.	Negligible	Slight
36	2 and 3 Birnam Terrace, Birnam	Category C Listed Building	High	Changes to setting.	Negligible	Slight
37	1 Birnam Terrace, Birnam	Category C Listed Building	High	Changes to setting.	Negligible	Slight

Asset No	Asset Name	Designation	Value (sensitivity)	Impact Description	Magnitude	Significance
44	Birnam Conservation Area	Conservation Area	Medium	Changes to setting and permanent reinforcement of severance with the Birnam Conservation Area to the north-east of the Highland Main Line railway.	Negligible	Neutral
497	Birnam War Memorial	None	Low	Changes to setting, affecting a key characteristic of this cultural heritage resource.	Negligible	Neutral
HLT 14	Murthly Castle	Listed on the Inventory of Gardens and Designed Landscapes	High	Permanent changes to land-use of an area of the Inventory garden and designed landscape and reinforcing severance of the cultural heritage resource to the west.	Moderate	**Large**

14.5 Potential Mitigation

14.5.1 In this section potential mitigation, taking into account best practice, legislation and guidance, which would be developed and refined during the DMRB Stage 3 assessment for whichever proposed route option is taken forward to DMRB Stage 3 as the Preferred Route Option. Potential mitigation could include:

- Development of the horizontal and/or vertical alignments to avoid or minimise impacts on cultural heritage resources. Design development should seek to avoid impacts in the first instance, and where this is not feasible should seek to minimise impacts.
- Where it is not possible to avoid or reduce impacts on cultural heritage resources, it may be possible to reduce the magnitude of impact through recording works in advance of or during construction, for example, archaeological excavation, watching brief, historic building recording and historic landscape recording, and the dissemination of the results of these works including readily accessible archives to provide a permanent record of the affected cultural heritage resource. In this way recording can reduce the magnitude of impact that would otherwise occur if a site were to be damaged or destroyed unrecorded.
- To mitigate the loss of information and access, an appropriate public archaeology and engagement programme would be considered as a valuable way to engage and educate a wide audience on their cultural heritage.
- In October 2015 HES outlined their position on the preservation by record of nationally important cultural heritage resources. In a short paper HES identified that preservation in situ through the avoidance of direct impacts is preferred and that proposed route options and detailed designs should aim to achieve this. Where avoidance is not possible measures to reduce the level of impact should be considered, but that preservation by record for a nationally important cultural heritage resources is a measure of last resort. In an email of 26 November 2015 HES suggested that for nationally important cultural heritage resources preservation by record does not reduce the overall significance of the effect.
    - In a similar statement 26 November 2015, the Perth and Kinross Heritage Trust (PKHT) outlined their position on preservation by record and its effectiveness in reducing the magnitude and significance of a development's impact. For designated cultural heritage resources, PKHT state that preservation by record is only acceptable in exceptional circumstances and where it has been exhaustively demonstrated that there are no alternative options. Preservation by record cannot remove the impact of development, but mitigation consisting of a programme of archaeological works can reduce impact by compensating for it. For non-designated cultural heritage resources, PKHT view is that preservation in situ should be sought for cultural heritage resources of regional or national importance, but that preservation by record is usually accepted as an effective way of mitigating impact, and mitigation would reduce the amount of information lost, and thereby does reduce the impact of the scheme.
- Measures to reduce physical impacts on cultural heritage resources resulting from accidental damage from the operation of construction plant can include:
    - appropriate temporary barriers to clearly identify and exclude cultural heritage resources from work areas;
    - appropriate temporary physical protection of cultural heritage resources to protect them during construction; and
    - tool box talks for construction staff to make them aware of the location of, and agreed protection methods for, cultural heritage resources.

- Mitigation for the potential effects of construction vibration, including effects from piling, are presented in Volume 1, Part 3 – Environmental Assessment (Chapter 16: Noise and Vibration, paragraphs 16.5.10 to 16.5.13).
- Historic England's Piling and Archaeology Guidance and Good Practice (2019) provides guidance on assessing the impact of piling on cultural heritage resources, including impacts from vibration. Table 2 of the guidance identifies permissible peak particle velocity (PPV) of vibration for specific types of structure. To establish the type of structure, permissible PPV and vibration thresholds, and specific mitigation to reduce the physical impacts on the Dunkeld and Birnam Station including Footbridge (Asset 26), the following would be undertaken:
  - Prior to construction works commencing, undertake a detailed structural survey of Asset 26 to understand the structural condition of the cultural heritage resource. This could include intrusive surveys, for example to assess the strength of the building's foundations.
  - Establish appropriate limit values and vibration thresholds; for example, vibration thresholds based on a vibration limit on the works of 6mm/s PPV.
  - Undertake vibration monitoring whilst the works are within an appropriate distance from Asset 26 to ensure that vibration thresholds are not exceeded, and ensure works cease until mitigation is put in place to reduce vibration.
- Specific mitigation for the potential effects of construction vibration resulting from piling are presented in Volume 1, Part 3 – Environmental Assessment (Chapter 16: Noise and Vibration, paragraph 16.5.12). Should vibration thresholds identified for piling for Asset 26 be exceeded, mitigation to reduce vibration potentially includes:
  - use of 'soft-start' piling techniques to reduce the vibration impacts generated by start-up and ramp down of the piling rig;
  - pre-augering or pre-excavation of pile route to remove obstructions and reduce the potential for high vibration events and increase the rate of pile insertions; and
  - where vibratory piling is proposed, to use percussive piling or an alternative method of piling, such as press piling.
- Explore opportunities for sustainable re-use of Dunkeld and Birnam Station including Footbridge (Asset 26).
- Measures to reduce impacts on the setting of archaeological remains and historic buildings and on historic landscapes potentially including:
  - Where appropriate the design of earthworks to avoid an overly engineered appearance and enable as much land as possible to be returned to previous land-use.
  - Avoidance of loss or damage to landscape features such as mature trees, walls, water features or field systems as far as possible.
  - Retention of existing trees and vegetation where possible and incorporation with new planting proposals.
  - Mitigation planting to aid integration of the proposed route option into the landscape. Planting would initially provide relatively limited screening but would mature and become more effective over time. It should be noted that unless designed sympathetically, mitigation planting can increase the impact on the setting of cultural heritage resources.
  - Sympathetic design within Conservation Areas and Inventory Gardens and Designed Landscapes that limits the changes to their setting.

14.5.2 Physical changes to Platform 1 (southbound) and Platform 2 (northbound) of Dunkeld and Birnam Station including Footbridge (Asset 26), a Category A Listed Building, and the removal of part of the

boundary wall of the garden of Birnam Bank House, Birnam (Asset 22), a Category C Listed Building, are likely to require Listed Building Consent under the Listed Buildings and Conservation Areas (Scotland) Act 1997.

14.5.3 Demolition of the existing Highland Main Line railway bridge over Inchewan Burn would require Conservation Area Consent under the Planning (Listed Buildings and Conservation Areas) (Scotland) Act 1997 (as amended by the Historic Environment Scotland Act, 2014).

14.6 Summary of Route Options Assessment

14.6.1 This section provides a summary of the DMRB Stage 2 assessment of potential impacts for the proposed route options. Two aspects are considered: whether any potential effects would be considered significant in the context of the EIA Regulations, and whether any of the significant potential effects identified differ sufficiently between proposed route options that they can be considered a differentiator and need to be considered as part of the overall identification of the Preferred Route Option (which, as explained in Volume 1, Part 3 – Environmental Assessment (Chapter 7: Overview of Environmental Assessment), takes into account environmental, engineering, economic and traffic considerations).

14.6.2 Construction of all proposed route options has the potential to result in accidental damage to Dunkeld and Birnam Station including Footbridge (Asset 26; a Category A Listed Building). However, the significance of this potential effect would be reduced to Slight significance through construction best practice as described in paragraph 14.5.1, such as safe working distances from construction plant. This is not a differentiator between proposed route options.

14.6.3 Construction of all proposed route options would partially remove the public forecourt (now the car park), which forms an important element of setting of Dunkeld and Birnam Station including Footbridge (Asset 26), would sever the pedestrian link between the Dunkeld & Birnam Station and Birnam from Station Road under the existing A9 via Birnam Glen and reinforce the existing severance of Asset 26 from Birnam.

14.6.4 In addition to the changes identified in paragraph 14.6.3, construction of Option ST2A or Option ST2B with access option 1 would result in physical changes to the station's northbound and southbound platforms and an additional change to the setting of the station through the presence of the extended platforms and the removal and replacement of the existing Highland Main Line railway bridge over Inchewan Burn. The potential impact resulting from these changes has been assessed to be of major magnitude and a potential effect of Very Large significance.

14.6.5 Construction of Option ST2A or Option ST2B with access option 3 would also result in these changes, with an additional change to the setting of the station resulting from the presence of a temporary pedestrian footbridge. The potential impact on Dunkeld and Birnam Station including Footbridge (Asset 26) resulting from these changes and from the changes identified in paragraph 14.6.3 has been assessed to be of major magnitude and a potential effect of Very Large significance.

14.6.6 Construction of Option ST2A, Option ST2B, Option ST2C and Option ST2D with access option 2 would avoid physical changes to the station platforms and changes to the setting of the station resulting from the extension to the platforms and the removal and replacement of the existing Highland Main Line railway bridge over Inchewan Burn. However, in addition to the changes identified in paragraph 14.6.3 these options would also result in an additional change to the setting of the station through the provision of a temporary pedestrian footbridge. The potential impact on Dunkeld and Birnam Station including Footbridge (Asset 26) has been assessed to be of major magnitude and a potential effect of Very Large significance.

14.6.7 While construction of Option ST2A or Option ST2B with access option 4, would result in the changes identified in paragraph 14.6.3, construction of these options would avoid the changes identified in

14.6.4, 14.6.5 and 14.6.6. The potential impact on Dunkeld and Birnam Station including Footbridge (Asset 26) resulting from the construction of Option ST2A or Option ST2B with access option 4, has therefore been assessed to be of major magnitude and a potential effect of Large significance.

14.6.8 While construction of Option ST2A or Option ST2B with access option 5 would result in the changes identified in paragraph 14.6.3, construction of these options would avoid the changes identified in 14.6.4 and 14.6.5. The potential impact on Dunkeld and Birnam Station including Footbridge (Asset 26) resulting from the construction of Option ST2A or Option ST2B with access option 5, has therefore been assessed to be of major magnitude and a potential effect of Very Large significance.

14.6.9 The potential impact on Dunkeld and Birnam Station including Footbridge (Asset 26) resulting from permanent changes to setting from the loss of the forecourt, the continued presence of the extension to Platform 1 (southbound) and Platform 2 (northbound) and the removal and replacement of the existing Highland Main Line railway bridge over Inchewan Burn during the operation of Option ST2A or ST2B with access option 1 or access option 3 has been assessed to be of moderate magnitude and a potential effect of Large significance.

14.6.10 Option ST2A or ST2B with access option 2, access option 4 or access option 5 do not require extensions to Platform 1 (southbound) and Platform 2 (northbound) and the removal and replacement of the existing Highland Main Line railway bridge over Inchewan Burn. During operation there would however be a potential impact on Dunkeld and Birnam Station including Footbridge (Asset 26) resulting from permanent changes to setting from the loss of the forecourt. This potential impact has been assessed to be of moderate magnitude and a potential effect of Moderate significance.

14.6.11 Option ST2C and ST2D with access option 2 do not require extensions to Platform 1 (southbound) and Platform 2 (northbound) and the removal and replacement of the existing Highland Main Line railway bridge over Inchewan Burn. During operation there would however be a potential impact on Dunkeld and Birnam Station including Footbridge (Asset 26) resulting from permanent changes to setting from the loss of the forecourt, the visible presence of the carriageway and associated infrastructure, and reinforcement of the existing separation between the station and Birnam. This potential impact has been assessed to be of moderate magnitude and a potential effect of Large significance.

14.6.12 Options ST2A and ST2B would significantly improve the physical connection between Dunkeld and Birnam Station including Footbridge (Asset 26) and Birnam. The significance of this potential effect has been assessed to be Large beneficial. Due to the provision of adjacent parking and access, these proposed route options would also significantly increase potential opportunities for re-use of the historic building. Options ST2C and ST2D would also improve the physical connection between Dunkeld & Birnam Station and Birnam. The significance of this potential effect has been assessed to be Slight beneficial. The replacement car park and pedestrian underpass would also provide some opportunities for the re-use of the building; however, these may be limited by vehicular access which would be for maintenance only. The difference in significance of the beneficial effects between Options ST2A and ST2B and Options ST2C and ST2D is a differentiator between the proposed route options.

14.6.13 Construction of Option ST2A including the new access road connecting to the western drive, Murthly Junction and three SuDS ponds, would result in land-take from Murthly Castle (HLT 14) Inventory garden and designed landscape. Construction of Options ST2B, ST2C and ST2D, including the new access road connecting to the western drive of Murthly Castle, Birnam Junction and two SuDS ponds, would also result in land-take from HLT 14. Construction of all proposed route options would also change the alignment of the western drive and reinforce the existing severance of the western end of HLT 14 and Birnam from the majority of the designed landscape to the east. These potential impacts would continue into operation. During construction and operation of all proposed route options the physical connection to Birnam and the route of the former riverside drive would be maintained. In addition, the key landscape features and the majority of the special features identified in the Inventory of Gardens and Designed Landscapes would not be affected and it is therefore considered unlikely that the rationale for current

definition of the inventory site boundary of the Murthly Castle (HLT 14) would be negated. However, it is unlikely that these potential impacts could be reduced through mitigation, and the significance of this residual effect for all proposed route options has been assessed to be Large. This is not a differentiator between proposed route options.

14.6.14 Construction of all proposed route options has the potential to result in accidental damage to Farnyhaugh, Military Bridge (Asset 189). This impact would be avoided through construction best practice. However, the continual presence of the SuDS pond would permanently change the setting of the cultural heritage resource, but not the understanding of it, or its value (sensitivity). The significance of residual effect during construction and operation for all proposed route options are not predicted to be significant.

14.6.15 Prior to mitigation, a potential effect of Moderate significance is predicted for Option ST2A and of Slight significance for the other options due to the removal of physical remains associated with Dalpowie Lodge (site of) (Asset 5) and of Moderate significance for all proposed route options due to the removal of Auchlou (Asset 793) historic building. Where it is not possible to develop a design to avoid physical impacts on these cultural heritage resources, mitigation in the form of archaeological excavation could be undertaken and building recording of Asset 793 is expected to be undertaken. Given that the physical remains for Asset 5 are unlikely to be complex and Asset 793 is a common vernacular building type, the significance of residual effect on these cultural heritage resources is not predicted to be significant. This is not a differentiator between proposed route options.

14.6.16 Option ST2A or Option ST2B with access option 1 or access option 3 would have a potential effect during construction and operation of Moderate significance on Birnam Conservation Area (Asset 44). The potential effect of Option ST2A and Option ST2B with access option 2 or access option 4 on the Conservation Area has been assessed to of Slight significance during construction and operation, while the potential effect resulting from Options ST2C and ST2D has been assessed to be of Slight significance during construction and of Neutral significance during operation.

14.6.17 The potential effect on Birnam Conservation Area (Asset 44) resulting from the construction and operation of either Option ST2A or Option ST2B with access option 1 or access option 3 is a differentiator between these proposed route options and the other proposed route options.

14.6.18 A summary assessment is provided in Table 14.16.

Table 14.16: Summary of Assessment Post Mitigation - Cultural Heritage

Chapter/ Subcategory			Residual Effects							Comments
			Option ST2A and Option ST2B with access option 1	**Option ST2A and Option ST2B with access option 2**	**Option ST2A and Option ST2B with access option 3**	**Option ST2A and Option ST2B with access option 4**	**Option ST2A and Option ST2B with access option 5**	**Option ST2C with access option 2**	**Option ST2D with access option 2**	
Cultural Heritage	**Construction**	Archaeological Remains	No potential effects are predicted to be significant or a differentiator between proposed route options							No potential effects are predicted to be significant and there is no differentiator between proposed route options.
		Historic Buildings	Physical impact on the platforms of Dunkeld and Birnam Station including Footbridge (Asset 26). Changes to the setting of Asset 26 and reinforcement of the existing severance of the station and Birnam. Introduction of noise and visual intrusion associated with the presence and operation of construction plant. The significance of this potential effect	Changes to the setting of Dunkeld and Birnam Station including Footbridge (Asset 26) and reinforcement of the existing severance of the station and Birnam. Introduction of noise and visual intrusion associated with the presence and operation of construction plant. The significance of this potential effect has been assessed to be **Very Large**.	Physical impact on the platforms of Dunkeld and Birnam Station including Footbridge (Asset 26). Changes to the setting of the station and reinforcement of the existing severance of the station and Birnam. Introduction of noise and visual intrusion associated with the presence and operation of construction plant.	Changes to the setting of Dunkeld and Birnam Station including Footbridge (Asset 26) and reinforcement of the existing severance of the station and Birnam. Introduction of noise and visual intrusion associated with the presence and operation of construction plant. The significance of this potential effect has been assessed to be **Large**.	Changes to the setting of Dunkeld and Birnam Station including Footbridge (Asset 26) and reinforcement of the existing severance of the station and Birnam. Introduction of noise and visual intrusion associated with the presence and operation of construction plant. The significance of this potential effect has been assessed to be **Very Large**.	Impact on the setting of Dunkeld and Birnam Station including Footbridge (Asset 26) and reinforcement of the existing severance of the station and Birnam. Introduction of noise and visual intrusion associated with the presence and operation of construction plant. The significance of this potential effect has been assessed to be **Very Large**.	Impact on the setting of Dunkeld and Birnam Station including Footbridge (Asset 26) and reinforcement of the existing severance of the station and Birnam. Introduction of noise and visual intrusion associated with the presence and operation of construction plant. The significance of this potential effect has been assessed to be **Very Large**.	The significance of effect has been assessed to be the same for Option ST2A and Option ST2B with access options 1, 2, 3 or 5, and Option ST2C and Option ST2D with access option 2. However, all proposed route options with access option 2 avoid physical impacts to the station's platforms and potential impacts to its setting resulting from the removal and replacement of the existing Highland Main Line railway bridge over Inchewan Burn. As such Option ST2A or Option ST2B with access option 2 has been assessed to have a

Chapter/ Subcategory			Residual Effects							Comments
			Option ST2A and Option ST2B with access option 1	Option ST2A and Option ST2B with access option 2	Option ST2A and Option ST2B with access option 3	Option ST2A and Option ST2B with access option 4	Option ST2A and Option ST2B with access option 5	Option ST2C with access option 2	Option ST2D with access option 2	
Cultural Heritage	Construction		has been assessed to be **Very Large**. Removal of elements within Birnam Conservation Area (Asset 44) and changes to character, reinforcement of the existing severance of the Conservation Area and introduction of noise and visual intrusion from construction traffic. The significance of this potential effect has been assessed to be **Moderate**.	Change of character, reinforcement of the existing severance of Birnam Conservation Area (Asset 44) and introduction of noise and visual intrusion from construction traffic. The significance of this potential effect has been assessed to be Slight.	The significance of this potential effect has been assessed to be **Very Large**. Removal of elements within Birnam Conservation Area (Asset 44) and changes to character, reinforcement of the existing severance of the Conservation Area and introduction of noise and visual intrusion from construction traffic. The significance of this potential effect has been assessed to be **Moderate**.	Change of character, reinforcement of the existing severance of Birnam Conservation Area (Asset 44) and introduction of noise and visual intrusion from construction traffic. The significance of this potential effect has been assessed to be Slight.	Change of character, reinforcement of the existing severance of Birnam Conservation Area (Asset 44) and introduction of noise and visual intrusion from construction traffic. The significance of this potential effect has been assessed to be Slight.	Removal of an area of woodland and roadside planting within Birnam Conservation Area (Asset 44). Introduction of noise and visual intrusion. Reinforcement of the existing severance of Birnam Conservation Area. The significance of this potential effect has been assessed to be Slight.	Removal of an area of roadside planting within Birnam Conservation Area (Asset 44). Introduction of noise and visual intrusion. Reinforcement of the existing severance of the area of Birnam Conservation Area. The significance of this potential effect has been assessed to be Slight.	slightly lower potential effect than Option ST2A or Option ST2B with access option 1 or access option 3. Option ST2A or Option ST2B with access option 3 results in an additional change to the setting of the station compared to Option ST2A or Option ST2B with access option 1. Option ST2A or Option ST2B with access option 1 or access option 3 are therefore considered to have a greater potential effect on the station than Option ST2A or Option ST2B with access option 2 or any of the other options. Due to the potential for **Moderate** adverse effect, Option ST2A or Option ST2B with access option 1 or access option 3 have been assessed to have a greater potential effect during construction on Birnam Conservation Area (Asset 44).

Chapter/ Subcategory			Residual Effects							Comments
			Option ST2A and Option ST2B with access option 1	Option ST2A and Option ST2B with access option 2	Option ST2A and Option ST2B with access option 3	Option ST2A and Option ST2B with access option 4	Option ST2A and Option ST2B with access option 5	Option ST2C with access option 2	Option ST2D with access option 2	
Cultural Heritage	Construction	Historic Landscape	Land-take from Murthly Castle (HLT 14) Inventory garden and designed landscape, reinforcement of the existing severance of HLT 14 and Birnam from the majority of the Inventory garden and designed landscape and potential impacts on the setting of Murthly Castle designed landscape (HLT 14). The significance of this potential effect has been assessed to be **Large**.	Land-take from Murthly Castle (HLT 14) Inventory garden and designed landscape, reinforcement of the existing severance of HLT 14 and Birnam from the majority of the Inventory garden and designed landscape and potential impacts on the setting of Murthly Castle designed landscape (HLT 14). The significance of this potential effect has been assessed to be **Large**.	Land-take from Murthly Castle (HLT 14) Inventory garden and designed landscape, reinforcement of the existing severance of HLT 14 and Birnam from the majority of the Inventory garden and designed landscape and potential impacts on the setting of Murthly Castle designed landscape (HLT 14). The significance of this potential effect has been assessed to be **Large**.	Land-take from Murthly Castle (HLT 14) Inventory garden and designed landscape, reinforcement of the existing severance of HLT 14 and Birnam from the majority of the Inventory garden and designed landscape and potential impacts on the setting of Murthly Castle designed landscape (HLT 14). The significance of this potential effect has been assessed to be **Large**.	Land-take from Murthly Castle (HLT 14) Inventory garden and designed landscape, reinforcement of the existing severance of HLT 14 and Birnam from the majority of the Inventory garden and designed landscape and potential impacts on the setting of Murthly Castle designed landscape (HLT 14). The significance of this potential effect has been assessed to be **Large**.	Land-take from Murthly Castle (HLT 14) Inventory garden and designed landscape, reinforcement of the existing severance of HLT 14 and Birnam from the majority of the Inventory garden and designed landscape and potential impacts on the setting of Murthly Castle designed landscape (HLT 14). The significance of this potential effect has been assessed to be **Large**.	Land-take from Murthly Castle (HLT 14) Inventory garden and designed landscape, reinforcement of the existing severance of HLT 14 and Birnam from the majority of the Inventory garden and designed landscape and potential impacts on the setting of Murthly Castle designed landscape (HLT 14). The significance of this potential effect has been assessed to be **Large**.	Potential effects are predicted to be significant, but as they are common to all there is no differentiator between proposed route options.
	Operation	Archaeological Remains	No potential effects are predicted to be significant or a differentiator between proposed route options							No potential effects are predicted to be significant and there is no differentiator between proposed route options.

Cultural Heritage	**Operation**	Historic Buildings	Impact on the setting of Dunkeld and Birnam Station including Footbridge (Asset 26) from permanent changes to setting resulting from loss of forecourt, the continued presence of the extension to Platform 1 (southbound) and Platform 2 (northbound) and the replacement Highland Main Line railway bridge over Inchewan Burn. The significance of effect has been assessed to be **Large**. Beneficial impact on the setting of Dunkeld and Birnam Station including Footbridge (Asset 26) from re-establishing the	Permanent changes to setting of Dunkeld and Birnam Station including Footbridge (Asset 26) resulting from loss of forecourt. The significance of effect has been assessed to be **Moderate**. Beneficial impact on the setting for Dunkeld and Birnam Station including Footbridge (Asset 26) from re-establishing the physical connection between the station and Birnam via Station Road. The significance of effect has been assessed to be **Large** beneficial. Provision of adjacent parking and access would significantly	Impact on the setting of Dunkeld and Birnam Station including Footbridge (Asset 26) from permanent changes to setting resulting from loss of forecourt, the continued presence of extension to Platform 1 (southbound) and Platform 2 (northbound) and the replacement Highland Main Line railway bridge over Inchewan Burn. The significance of effect has been assessed to be **Large**. Beneficial impact on the setting of Dunkeld and Birnam Station including Footbridge (Asset 26) from re-establishing the	Permanent changes to setting of Dunkeld and Birnam Station including Footbridge (Asset 26) resulting from loss of forecourt. The significance of effect has been assessed to be **Moderate**. Beneficial impact on the setting for Dunkeld and Birnam Station including Footbridge (Asset 26) from re-establishing the physical connection between the station and Birnam via Station Road. The significance of effect has been assessed to be **Large** beneficial. Provision of adjacent parking and access would significantly	Permanent changes to setting of Dunkeld and Birnam Station including Footbridge (Asset 26) resulting from loss of forecourt. The significance of effect has been assessed to be **Moderate**. Beneficial impact on the setting for Dunkeld and Birnam Station including Footbridge (Asset 26) from re-establishing the physical connection between the station and Birnam via Station Road. The significance of effect has been assessed to be **Large** beneficial. Provision of adjacent parking and access would significantly	Impact on the setting of Dunkeld and Birnam Station including Footbridge (Asset 26) from the permanent loss of the forecourt (now car park) and the visible presence of the carriageway and associated infrastructure. The significance of effect has been assessed to be **Large**. Beneficial impact from the improved physical connection between Dunkeld and Birnam Station including Footbridge (Asset 26) and Birnam. The significance of effect has been assessed to be Slight beneficial. The replacement car park and pedestrian	Impact on the setting of Dunkeld and Birnam Station including Footbridge (Asset 26) from the permanent loss of the forecourt (now car park) and the visible presence of the carriageway and associated infrastructure. The significance of effect has been assessed to be **Large**. Beneficial impact from the improved physical connection between Dunkeld and Birnam Station including Footbridge (Asset 26) and Birnam. The significance of effect has been assessed to be Slight beneficial. The replacement car park and pedestrian	Option ST2A and Option ST2B with access option 1 or access option 3 would have the potential for a more significant effect on Dunkeld and Birnam Station including Footbridge (Asset 26) than Option ST2A and Option ST2B with access option 2, access option 4 or access option 5. Option ST2A and Option ST2B with access option 2, access option 4 or access option 5 are also predicted to have lower impact on Dunkeld and Birnam Station including Footbridge (Asset 26) than Option ST2C and Option ST2D. However, for Options ST2A and ST2B with all access options there would be a **Large** beneficial effect on Dunkeld and Birnam Station including Footbridge (Asset 26) while for Options ST2C and ST2D a Slight beneficial effect has been assessed.

Cultural Heritage	**Operation**		physical connection between the station and Birnam via Station Road. The significance of effect has been assessed to be **Large** beneficial. Provision of adjacent parking and access would significantly increase potential opportunities for re-use of the historic building. **Moderate** adverse effect on Birnam Conservation Area (Asset 44) due to permanent changes to character, loss of elements within the Conservation Area and reinforcement of the existing severance.	increase potential opportunities for re-use of the historic building. Slight adverse effect on Birnam Conservation Area (Asset 44) due to changes to the character and reinforcement of the existing severance of the Conservation Area.	physical connection between the station and Birnam via Station Road. The significance of effect has been assessed to be **Large** beneficial. Provision of adjacent parking and access would significantly increase potential opportunities for re-use of the historic building. **Moderate** adverse effect on Birnam Conservation Area (Asset 44) due to permanent changes to character, loss of elements within the Conservation Area and reinforcement of the existing severance.	increase potential opportunities for re-use of the historic building. Slight adverse effect on Birnam Conservation Area (Asset 44) due to changes to the character of the Conservation Area and reinforcement of the existing severance of the Conservation Area.	increase potential opportunities for re-use of the historic building. Slight adverse effect on Birnam Conservation Area (Asset 44) due to changes to the character of the Conservation Area and reinforcement of the existing severance of the Conservation Area.	underpass would provide some opportunities for the re-use of the building; however, these may be limited by vehicular access from the A9 which would be for maintenance only and emergency access only. Neutral effect resulting from changes to setting and permanent reinforcement of severance with the Birnam Conservation Area (Asset 44) to the north-east of the Highland Main Line railway.	underpass would provide some opportunities for the re-use of the building; however, these may be limited by vehicular access from the A9 which would be for maintenance only and emergency access only. Neutral effect resulting from changes to setting and permanent reinforcement of severance with the Birnam Conservation Area (Asset 44) to the north-east of the Highland Main Line railway.	Due to the **Moderate** adverse effect, Option ST2A or Option ST2B with access option 1 or access option 3 have been assessed to have a greater effect during operation on Birnam Conservation Area (Asset 44).

Chapter/ Subcategory			Residual Effects							Comments
			Option ST2A and Option ST2B with access option 1	**Option ST2A and Option ST2B with access option 2**	**Option ST2A and Option ST2B with access option 3**	**Option ST2A and Option ST2B with access option 4**	**Option ST2A and Option ST2B with access option 5**	**Option ST2C with access option 2**	**Option ST2D with access option 2**	
Cultural Heritage	**Operation**	Historic Landscape	Permanent land-take would reinforce the existing severance and impact on the setting of Murthly Castle designed landscape (HLT 14). The significance of effect has been assessed to be **Large**.	Permanent land-take would reinforce the existing severance and impact on the setting of Murthly Castle designed landscape (HLT 14). The significance of effect has been assessed to be **Large**.	Permanent land-take would reinforce the existing severance and impact on the setting of Murthly Castle designed landscape (HLT 14). The significance of effect has been assessed to be **Large**.	Permanent land-take would reinforce the existing severance and impact on the setting of Murthly Castle designed landscape (HLT 14). The significance of effect has been assessed to be **Large**.	Permanent land-take would reinforce the existing severance and impact on the setting of Murthly Castle designed landscape (HLT 14). The significance of effect has been assessed to be **Large**.	Permanent land-take would reinforce the existing severance and impact on the setting of Murthly Castle designed landscape (HLT 14). The significance of effect has been assessed to be **Large**.	Permanent land-take would reinforce the existing severance and impact on the setting of Murthly Castle designed landscape (HLT 14). The significance of effect has been assessed to be **Large**.	Effects are predicted to be significant, but this is not a differentiator between route options.

Compliance Against Plans and Policies

14.6.19 DMRB LA 104 states that environmental assessment, reporting and monitoring shall meet the requirements of the national planning policy for each relevant Overseeing Organisation.

14.6.20 *Appendix A21.1 (Assessment of Policy Compliance)* provides a review of national, regional and local policy documents which are of relevance to this assessment undertaken and reported in this chapter in accordance with DMRB guidance.

14.6.21 National planning policy objectives (and accompanying best practice guidance) of relevance to this assessment are provided in National Planning Framework 3 (Scottish Government, 2014b), Scottish Planning Policy (SPP) (Scottish Government, 2014a; Revised 2020) theme *Valuing the Historic Environment*, as well as the Historic Environment Policy for Scotland (HEPS) (HES, 2019a) and PAN 2/2011 (Planning and Archaeology) (Scottish Government, 2011). In addition, local policies of relevance include Perth and Kinross Local Development Plan 2 (PKC LDP2) (PKC, 2019) Policies 26 (Scheduled Monuments and Archaeology), 27 (Listed Buildings), 28 (Conservation Areas), 30 (Protecting, Promotion and Interpretation of Historic Battlefields) and 31 (Other Historic Environment Assets). TAYplan Policies 2 (Shaping Better Quality Places) and 9 (Managing TAYplan's Assets) are also of relevance (TAYplan, 2017).

14.6.22 A full policy compliance assessment can be found in Table 6 of *Appendix A21.1 (Assessment of Policy Compliance)*. Overall, there are areas of compliance and non-compliance with policies related to Cultural Heritage. Particular areas of non-compliance are in relation to the potential impacts on the Category A listed Dunkeld & Birnam Station, and the Murthly Castle designed landscape as a result of all proposed route options. A more detailed assessment would be undertaken at DMRB Stage 3, however at this DMRB Stage 2 assessment the proposed route options are not considered to comply with national to local policy.

Community Objectives

14.6.23 The community objectives (refer to Volume 1, Part 3 – Environmental Assessment (Chapter 7: Overview of Environmental Assessment, Table 7.2)) have been considered throughout DMRB Stage 2. *Appendix A7.1: Mapping of Community Objectives Against DMRB Stage 2 Route Options* sets out which DMRB Stage 2 environmental topics are relevant to each of the objectives.

14.6.24 *Appendix A7.1: Mapping of Community Objectives Against DMRB Stage 2 Route Options* confirms that community objective 7 is relevant to the assessment of impacts to Cultural Heritage. Professional judgement has been used to consider how the proposed route options contribute to these objectives for the operation phase, as summarised in Table 14.17.

14.6.25 The contribution of the operation phase of each of the proposed route options to the relevant community objectives was categorised according to the following key.

Contributes to all/most of the community objective	
Contributes to part of the community objective	
Contributes to little/none of the community objective	

Table 14.17: Contribution to Community Objectives During Operation for this Environmental Topic

Relevant Community Objective		Option ST2A	Option ST2B	Option ST2C	Option ST2D
7	Preserve and enhance the integrity of the unique and rich historical and cultural features of the Dunkeld, Birnam and Inver communities, thereby supporting well-being and the local economy.				

14.6.26 All proposed route options are considered to contribute in part to objective 7, as there are opportunities for improvements and potential adverse impacts during construction and operation for each proposed route option.

Comparative Assessment

14.6.27 Construction of all proposed route options would partially remove the public forecourt (now the car park) of Dunkeld and Birnam Station including Footbridge (Asset 26), would sever the pedestrian link between the Dunkeld & Birnam Station and Birnam from Station Road under the existing A9 via Birnam Glen, introduce noise and visual intrusion from construction activities, and reinforce the existing severance of Asset 26 from Birnam.

14.6.28 In addition to the potential impact resulting from the changes identified in paragraph 14.6.24, construction of Option ST2A or Option ST2B with access option 3 would also result in physical changes to the station's northbound and southbound platforms and a change to the setting of the station through the presence of the extended platforms and the removal and replacement of the existing Highland Main Line railway bridge over Inchewan Burn. Construction of Option ST2A or Option ST2B with access option 3 would also result in an additional change to the setting of the station due to the presence of a temporary pedestrian footbridge. Construction of Option ST2A or Option ST2B with access option 3 has therefore been assessed to have the highest potential effect on the station.

14.6.29 Construction of Option ST2A or Option ST2B with access option 1 would result in the potential impact identified in paragraph 14.6.24 and would also result in physical changes to the station's northbound and southbound platforms, a change to the setting of the station through the presence of the extended platforms and the removal and replacement of the existing Highland Main Line railway bridge over Inchewan Burn. It would not however result in an additional change to the setting of the station resulting from the presence of a temporary pedestrian footbridge. Thus, while the significance of effect has been assessed to be the same (i.e. of Very Large significance), Option ST2A or Option ST2B with access option 1 has been assessed to have less potential effect on Dunkeld and Birnam Station including Footbridge (Asset 26) than Option ST2A or Option ST2B with access option 3.

14.6.30 While construction of all proposed route options with access option 2 would result in the changes identified in paragraph 14.6.24 it would avoid physical impacts to the station's platforms and changes to the setting of the station resulting from the extension to the platforms and the removal and replacement of the existing Highland Main Line railway bridge over Inchewan Burn. Thus, while the significance of the potential effect has been assessed to be the same (i.e., of Very Large significance), all proposed route options with access option 2 are assessed to have less potential effect on the station than both Option ST2A or Option ST2B with access option 3.

14.6.31 While construction of Option ST2A or Option ST2B with access option 4, Option ST2C or Option ST2D would result in the changes identified in paragraph 14.6.24 it would not result in the changes identified in paragraphs 14.6.25, 14.6.26 or 14.6.27. The significance of the potential effect resulting from the construction of these options has therefore been assessed to be Large, and therefore these options have been assessed to have a lower potential effect on the station during construction than the other options.

14.6.32 Construction of Option ST2A or Option ST2B with access option 5, would result in the changes identified in paragraph 14.6.24 and 14.6.27, it would not result in the changes identified in paragraphs 14.6.25 or 14.6.26. The significance of the potential effect resulting from the construction of these options has therefore been assessed to be Very Large, and therefore these options have been assessed to have a higher potential effect on the station during construction than the Option ST2A or Option ST2B with access option 4.

14.6.33 No difference in the significance of the potential effect (i.e. Large adverse significance) resulting from operation of Option ST2A or ST2B with access option 1 or access option 3, or Option ST2C and Option ST2D has been assessed. As the potential effect resulting from the operation of Option ST2A and Option ST2B with access option 2, access option 4 or access option 5 has been assessed to be of Moderate adverse significance, these options are considered to have the lowest potential effect on Asset 26 during operation.

14.6.34 Option ST2A or ST2B with access options 1 and 3 are also predicted to have the highest potential effect on Birnam Conservation Area (Asset 44) (assessed to be of Moderate significance).

14.6.35 While the Large beneficial potential effect on Dunkeld and Birnam Station including Footbridge (Asset 26) during operation is acknowledged, as a result of being assessed to have the highest adverse potential impact on Dunkeld and Birnam Station including Footbridge (Asset 26) during construction (see paragraph 14.6.25) and a potential effect of Moderate adverse significance on Birnam Conservation Area (Asset 44) during operation, Option ST2A or ST2B with access option 3 is considered to have the highest overall effect.

14.6.36 While the significance of effect on Birnam Conservation area (Asset 44) has been assessed to be the same as for Option ST2A or ST2B with access option 3, as described in paragraph 14.6.26 Option ST2A or ST2B with access option 1 are considered to have a lower potential impact on the station than Option ST2A or ST2B with access option 3. Option ST2A or ST2B with access option 1 have therefore been assessed to have an intermediate overall effect.

14.6.37 Like Option ST2A or ST2B with access option 3, Option ST2A or ST2B with access option 2 and access option 5 would also have an effect of Very Large adverse significance during construction, however the significance of the potential effect on the station during operation (assessed to be of Moderate adverse significance) is predicted to be lower than for Option ST2A or ST2B with access option 3. Option ST2A or ST2B with access option 2 and access option 5 have therefore been assessed to have an intermediate overall effect.

14.6.38 While the Slight beneficial potential effect on Dunkeld and Birnam Station including Footbridge (Asset 26) during operation is not as great as the Large beneficial potential effect assessed during operation for Option ST2A or ST2B with access option 3, due to the lower impact on the station during construction (assessed to be Large adverse significance) and to the Conservation Area (Asset 44) during construction and operation (assessed to be Slight adverse and Neutral significance respectively), Options ST2C and ST2D have been assessed to have a lower overall effect than ST2A or ST2B with access option 3. Option ST2C or ST2D have therefore been assessed to have an intermediate overall effect.

14.6.39 The significance of the adverse and beneficial potential effects on Dunkeld and Birnam Station including Footbridge (Asset 26) during operation and the significance of the potential effects on Birnam Conservation Area (Asset 44) during construction and operation have been assessed to be the same as

for Option ST2A or Option ST2B with access option 2. However, the Large significance of the potential effect resulting from the construction of Option ST2A or ST2B with access option 4 is lower than the Very Large significance of the potential effect on Dunkeld and Birnam Station including Footbridge (Asset 26) during construction assessed for Option ST2A or ST2B with access option 2. Option ST2A or ST2B with access option 4 has therefore been assessed to have the lowest overall effect of the proposed route options.

14.6.40 The results of the comparative assessment are summarised in Table 14.18.

Table 14.18: Comparative Assessment – Cultural Heritage

Route Option	Lowest Overall Effect	Intermediate Overall Effect	Highest Overall Effect
ST2A with access option 1		✓	
ST2A with access option 2		✓	
ST2A with access option 3			✓
ST2A with access option 4	✓		
ST2A with access option 5		✓	
ST2B with access option 1		✓	
ST2B with access option 2		✓	
ST2B with access option 3			✓
ST2B with access option 4	✓		
ST2B with access option 5		✓	
ST2C with access option 2		✓	
ST2D with access option 2		✓	

14.7 Scope of Stage 3 Assessment

14.7.1 The Stage 3 assessment for cultural heritage would be undertaken in accordance with DMRB LA 104 and DMRB LA 106.

14.7.2 It is envisaged that the baseline scenario for the cultural heritage would be established through:

- revisiting sources consulted for the DMRB Stage 2 assessment and consulting additional sources, including historic mapping, published and unpublished archaeological reports and other relevant bibliographic sources, and aerial photographs;
- a Lidar survey of Murthly Castle Garden and Designed Landscape;
- a historic environment desk-based assessment of Murthly Castle Garden and Designed Landscape; and
- undertaking a walkover survey.

14.7.3 In addition, geophysical survey may be undertaken within suitable areas that would be impacted by construction of the Preferred Route Option. The results of the DMRB Stage 2 assessment have not identified the need for intrusive surveys to enable the impact of the project to be understood or to allow the design of appropriate mitigation. Further consultation would be undertaken with Perth & Kinross Heritage Trust on archaeological fieldwork required to inform the DMRB Stage 3 assessment.

14.7.4 Potential impacts on the setting of cultural heritage resources would be assessed based on the guidance provided by Managing Change in the Historic Environment: Setting (HES, 2020a). A three-stage process is proposed to assess the impact of the chosen route on the setting of the cultural heritage resources comprising:

- Stage 1: identify the cultural heritage resources that might be affected by the Preferred Route Option.
- Stage 2: define the setting of cultural heritage resources by establishing how the surroundings contribute to the ways in which the cultural heritage resource is understood, appreciated and experienced.
- Stage 3: assess how the Preferred Route Option would affect that setting.

14.7.5 Potential impacts on Murthly Castle (HLT 14), Dunkeld House (HLT 19) and The Hermitage (HLT 20) Inventory gardens and designed landscapes would be assessed based on the guidance provided by Managing Change in the Historic Environment: Gardens and Designed Landscapes (HES, 2020b). A three-stage process is proposed to assess the impact of the Preferred Route Option on these Inventory gardens and designed landscapes comprising:

- Stage 1: identify the key landscape features and special features that might be affected by the Preferred Route Option using the Inventory site description and any further information and/or research that may be required in understanding the significance of the garden and designed landscape.
- Stage 2: define the ways the key landscape features, special features, character and integrity of the garden designed landscapes might be affected by the Preferred Route Option, and its capacity to accommodate this change. Impacts are defined as direct, setting and cumulative.
- Stage 3: assess how impacts resulting from the Preferred Route Option would be reduced for example through design.

14.8 References

Legislation

Historic Environment Scotland Act 2014

Planning (Listed Buildings and Conservation Areas) (Scotland) Act 1997 (as amended by the Historic Environment Scotland Act, 2014)

Town and Country Planning (Development Management Procedure) (Scotland) Regulations 2013

Reports and Documents

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Ordnance Survey, Perth and Clackmannanshire, Sheet LXI.SE, 6" to the mile, surveyed 1899, published 1900.

Ordnance Survey, Perth and Clackmannanshire, Sheet LXI.NE, 6" to the mile, surveyed 1898, published 1900.

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Aerial Photographs

Sortie	Frames	Date	Lib
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Not known	041	2001	E11041

15. Air Quality

15.1 Introduction

15.1.1 This chapter presents the results of the air quality assessment for the Design Manual for Roads and Bridges (DMRB) Stage 2 assessment of the proposed route options. Further detailed information on this assessment is provided in *Appendix A15.1: Air Quality Annexes*.

15.1.2 Air quality is a term used to describe concentrations of specific pollutants in ambient air, taking into account their effects on sensitive receptors, which include human health receptors, EU Limit Value Compliance locations and designated habitats. The main pollutants of concern in the UK are associated with combustion emissions typically arising from vehicle traffic and industry, and are primarily oxides of nitrogen (NO_x), nitrogen dioxide (NO_2) and particulate matter (PM) (PM_{10} and $PM_{2.5}$). In relation to sensitive designated habitats, nitrogen (N) deposition is also considered in Volume 1, Part 3 – Environmental Assessment (Chapter 11: Biodiversity).

15.1.3 The assessment reported in this chapter considers these pollutants in terms of concentrations (at the local level), and dust deposition associated with the construction phase of the project. Dust deposition occurs when PM is generated and/or dispersed into the atmosphere from construction activities and traffic associated with construction works, settles onto a surface.

15.1.4 In November 2019, the DMRB guidance Volume 11 was updated including the publication of DMRB LA 105 'Air quality' (Highways England et al., 2019) which replaces HA 207/07, and the associated Interim Advice Notes (IANs) IAN 170/12, IAN 174/13, IAN 175/13 and part of IAN 185/15, which have all been withdrawn. This assessment has been updated to align with DMRB LA 105. The emission factors, background maps and associated modelling tools extant at the commencement of the DMRB Stage 2 assessment remain unchanged. Further information is provided in Section 15.2.

Legislation and Policy Background

15.1.5 This assessment considers relevant air quality legislation and policy. As described in Volume 1, Part 3 – Environmental Assessment (Chapter 7: Overview of Environmental Assessment) relevant pre-Brexit EU legislation now transposed into UK law is also referenced. The key air quality legislation relevant to this assessment is summarised in this section and listed below:

- Directive 2008/50/EC on ambient air quality and cleaner air for Europe (the CAFE Directive).
- The Air Quality Standards (Scotland) Regulations 2010 transpose formalised limit values set out in the EU Ambient Air Quality Directive 2008/50/EC to Scottish law.
- The Air Quality Strategy (AQS) for England, Scotland, Wales and Northern Ireland, 2007 which updates the 2000 National Air Quality Strategy and sets out how local air quality is managed, through the application of Air Quality Objectives (AQOs) based on the Air Quality (Scotland) Regulations 2000 and 2002 Amendment Regulations and the Air Quality (Scotland) Amendment Regulations 2016.
- Environment Act 1995, Part IV defines requirements for Local Air Quality Management.
- Environment Protection Act 1990, amended by the Pollution Prevention and Control Act 1999, Part III provides statutory nuisance provisions for nuisance dust.

15.1.6 Directive 2008/50/EC was published to consolidate previous European Directives on ambient air quality. Although published in 2007, the Air Quality Strategy (AQS) remains consistent with Directive 2008/50/EC. The UK Government leads on the UK's input to International legislation relating to air quality, with input from the Scottish Government, and the other devolved administrations. The UK government and governments of EU member states are currently in negotiations with the European Commission over breaching limit values for nitrogen dioxide (NO_2) and PM_{10} (particulate matter (dust) with an aerodynamic diameter of less than 10 microns).

15.1.7 The first Air Quality Plan, for NO_2 in the UK (Defra, 2015a) outlined how air quality in the UK would be improved by reducing NO_2 emissions in towns and cities. A revised UK Air Quality Plan was published in July 2017 (Defra & DfT, 2017), but the most recent ruling from the High Court in February 2018 (ClientEarth (No.3) v SoSEFRA, SoSfT, WM, 2018) concluded that this plan is insufficient to bring compliance with the EU air quality Limit Values within the soonest timeframe possible.

15.1.8 In May 2018, Defra released a consultation draft of the Clean Air Strategy 2018, outlining actions to tackle emissions from a range of pollutant sources. The consultation on this draft informed the final Clean Air Strategy (Defra, 2019a) and National Air Pollution Control Programme (Defra, 2019b) published in January 2019 and March 2019, respectively.

15.1.9 The AQS establishes AQOs for a number of specific pollutants. The main air pollutants relating to road traffic are NO_x, NO_2 and PM_{10}. The other pollutants in the AQS are screened out here as being unlikely to be of concern based on DMRB LA 105 'Air quality' (Highways England et al., 2019), because these AQOs are unlikely to be at risk of being breached as a consequence of a road development.

15.1.10 The AQS introduced measures to control exposure to $PM_{2.5}$ (the fraction of PM with an average aerodynamic diameter less than 2.5 micrometres; μm). The strategy sets out the Air Quality Standards and Objectives which have been set to benchmark air quality in terms of protecting human health and the environment. However, within the UK, air quality is a devolved matter, with the Scottish Government having responsibility for the development of air quality policy and legislation for Scotland.

15.1.11 The AQOs applicable to LAQM in Scotland are set out in the Air Quality (Scotland) Regulations 2000 (Scottish SI 2000 No 97), the Air Quality (Scotland) (Amendment) Regulations 2002 (Scottish SI 2002 No 297) and the Air Quality (Scotland) Amendment Regulations 2016 (Scottish SI 2016 No 162). The pollutants relevant to this assessment are nitrogen dioxide (NO_2), NO_x, PM_{10} and $PM_{2.5}$. The National AQS for England, Scotland, Wales and Northern Ireland (the AQS) also provides for a non-statutory objective for NO_x. Similar legal limits are set at EU level, where they are called limit values. These are set out in the European 2008 Ambient Air Quality Directive (2008/50/EC) and transposed into Scottish legislation by the Air Quality Standards (Scotland) Regulations 2010. It is the responsibility of Scottish Government and the governments of EU Member States to achieve the legal limit values.

15.1.12 The relevant objective values and limit values are listed in Table 15.1 and further discussed in Section 15.2 (Approach and Methods) under Air Quality Thresholds.

Table 15.1: Relevant Air Quality Limit Values and National Air Quality Objectives

Pollutant	Averaging Period	Limit Value (LV)/ Objective (O)	Limit Value/Objective Target Date
Nitrogen Dioxide (NO_2) (for human health)	Annual mean	40 µg/m^3 (LV)	31/12/2005
	1 hour mean	200 µg/m^3 (not to be exceeded more than 18 times/yr) (LV)	31/12/2005
Particulate Matter (PM_{10}) (for human health)	24 hour mean	50 µg/m^3 not to be exceeded more than 7 times/yr (O)	31/12/2000
	Annual mean	18 µg/m^3 (O)	31/12/2000
Particulate Matter ($PM_{2.5}$) (for human health)	Annual mean	10 µg/m^3 (O)	31/12/2020
Nitrogen Oxide (NO_x) (for designated habitats)	Annual mean	30 µg/m^3 (LV)	31/12/2000

15.1.13 For a full description of the terms used in relation to air quality, the science and the legislation, reference should be made to the AQS documents, and to the supporting Defra Local Air Quality Management (LAQM) Technical Guidance, referred to hereafter as 'LAQM TG(16)'.

15.1.14 There are no assessment methods available that can produce robust predictions of short-term concentrations from road traffic. Therefore, compliance with the short-term AQOs is assessed by following the guidance presented in LAQM TG(16), which provides a relationship between the annual mean concentration and the number of periods per year where the short-term AQO is likely to be exceeded. These relationships have been derived from examination of monitoring data across the UK.

15.1.15 The annual mean equivalent concentration for the NO_2 1 hour mean AQO is 60µg/m^3. Whilst the annual mean equivalent concentration for the PM_{10} 24 hour mean AQO (i.e. for the number of 24-hour mean exceedances to be met) is 22.4µg/m^3, in accordance with the formula set out in paragraph 7.93 of LAQM TG(16) (Defra,2018a).

15.2 Approach and Methods

Overview of Methodology

15.2.1 The assessment considers local air quality. DMRB LA 105 'Air quality' (Highways England et al., 2019), hereafter referred to as DMRB LA 105 (formerly DMRB HA 207/07) sets out two levels of assessment: 'Simple' and 'Detailed'.

- Simple Assessment is considered appropriate if air quality is not expected to be a fundamental issue in the decision-making process; and
- Detailed Assessment intended to be applied where the potential exists to cause significant effects on resources and receptors.

15.2.2 For this DMRB Stage 2 assessment, a Simple Assessment has been undertaken for all proposed route options (refer to paragraph 15.2.14). A Simple Assessment is considered appropriate, having taken into account the nature of the proposed route options (generally online widening of an existing road through an area of low background pollutant concentrations where no air quality issues have previously been identified by the local authority). However, where an option poses a higher air quality risk or is more complex to assess, such as the design incorporating a tunnel or underpass, a more detailed assessment approach has been used. Further details of the calculations involved are provided in paragraph 15.2.18.

Construction

15.2.3 Sufficient detailed information on construction activities and traffic are unavailable at this stage to undertake an assessment in accordance with DMRB LA 105. Construction phase impacts would be considered in more detail as necessary during the DMRB Stage 3 assessment of the Preferred Route Option.

Operation

15.2.4 Impacts and effects of the proposed route options were assessed for the expected first full year of operation of the A9 Dualling Programme (anticipated to be 2026) comparing against data for a baseline year of 2015. The baseline traffic data used were sourced from the A9DTM15 traffic model. A 2015 baseline year has been used for the air quality assessment, as it is the latest year for which traffic data and monitoring data are available, which would allow for model verification.

15.2.5 The changes in pollutant emissions and resulting concentrations within the defined study area were compared between scenarios for each of the proposed route options in place, termed 'Do-Something' (DS) scenarios, and scenarios without proposed route options in place, termed 'Do-Minimum' (DM).

Study Area

15.2.6 The assessment considered changes in key pollutant concentrations, at worst-case sensitive receptor locations (as set out in paragraph 15.2.19 and 15.2.23) located within 200m of 'affected roads' (as defined in paragraph 15.2.7 and 15.2.8).

15.2.7 The affected roads were identified using the following criteria:

- horizontal road alignment would change by 5m or more; or
- daily traffic flows anticipated to change by 1,000 Annual Average Daily Traffic (AADT) or more; or
- Heavy Duty Vehicle (HDV) flows anticipated to change by 200 AADT or more; or
- daily average speed anticipated to change by 10km/hr or more; or a
- peak hour speed anticipated to change by 20km/hr or more.

15.2.8 The worst-case receptors (primarily residential properties and designated habitats) within 200m of road links that experience a change in traffic flows that exceed the above criteria (i.e. the affected road network (ARN)) were included in the assessment. The total study area for the air quality assessment then encompasses all road links within 200m of all identified receptors and up to 500m either end of the scheme.

Air Quality Calculations

15.2.9 Likely impacts and effects on local air quality during the operation phase were assessed in accordance with DMRB LA 105 which supports Defra's observations that while there was a clear decrease in NO_2 concentrations between 1996 and 2002, there has been little to no reduction between 2004 and 2010. A similar pattern exists for NO_x concentrations over the same period.

15.2.10 A consequence of these observations is that there is now a gap between current projected vehicle emission reductions and projections based on the annual rate of improvements in ambient air quality. Attempting to address this gap, the 'gap analysis' approach provides future NO_x and NO_2 projection adjustment factors which have been used in this assessment. It is acknowledged that these published adjustment factors may be too pessimistic, resulting in overly high concentration predictions, due to anticipated reductions in emissions from Euro 6/VI vehicles. Beyond 2017, concentration predictions are expected to be conservative (i.e. worst-case).

15.2.11 The assessment has also been undertaken following Defra's Technical Guidance on Local Air Quality Management (LAQM.TG(16)) (Defra, 2018a).

Background Pollutant Concentrations

15.2.12 Background annual mean concentrations of NO_x, NO_2, and PM_{10} were obtained from Scottish Government air quality maps (Scottish Government, 2018a)[1]. These maps include a component from Motorway, Trunk and Primary A-road emission sources. To avoid double-counting of these emissions in the assessment, the road component has been removed from the background concentration values, using Defra's sector removal tool (NO_2 Adjustment for NO_x Sector Removal Tool v6.0) for NO_2 concentrations (Defra, 2017a)[2]. The sector removal approach undertaken followed the LAQM.TG(16) guidance.

15.2.13 As annual mean concentrations of $PM_{2.5}$ are not available on the Scottish Government's website, these were estimated by applying the ratio obtained between Defra's mapped background annual mean concentrations of PM_{10} and $PM_{2.5}$ to the Scottish Government's mapped concentrations for PM_{10}.

Predicted Pollutant Concentrations at Human Health Receptors

15.2.14 Emissions of pollutants were calculated for each affected road link using Defra's Emissions Factors Toolkit[3] (EFT v8.0.1) (Defra, 2017b). The total road traffic contribution to pollutant concentrations at each selected sensitive receptor was calculated by combining contributions from all road links within 200m using the equations stated in DMRB HA 207/07 Annex C3.2[4].

15.2.15 Total concentrations of annual mean PM_{10} and $PM_{2.5}$ have been calculated by adding respective road traffic contributions to their equivalent background concentration.

15.2.16 Total concentrations of annual mean NO_2 have been calculated using annual mean NO_x concentrations and Defra's 2017 NO_x/NO_2 calculator (v6.1)[5].

Predicted Pollutant Concentrations at Designated Habitat Receptors

15.2.17 The annual mean road NO_x concentrations have been calculated for ecological receptors and converted to NO_2 using the Defra 2017 NO_x/NO_2 calculator (v6.1). The predicted road NO_2 was converted to nitrogen deposition rate following DMRB LA 105.

[1] The Scottish Government updated their background estimates in 2019. Further updates by Defra have since been published as discussed in footnotes 2, 3 and 5. The 2020 publications are currently unavailable on the Scottish Government website. As EFT version 8.0.1 and the associated tools described in footnotes 2, 3 and 5 were extant at the time of the original assessment, low concentrations of pollutant emissions are predicted in the study area, and this study is a comparative assessment of different options, the use of the updated tools and guidance would not materially alter the conclusions of this assessment. The most up to date version of the backgrounds and associated tools would be used during the DMRB Stage 3 assessment and reported in the EIA Report.

[2] In August 2020 Defra released an update of the sector removal tool (version 8.0), reflecting updates to underlying data as discussed in footnote 3. As version 6.0 was extant at the time of the assessment, low concentrations of pollutant emissions are predicted in the study area, and this study is a comparative assessment of different options, the use of the updated tools and guidance would not materially alter the conclusions of this assessment. The most up to date version would be used during the DMRB Stage 3 assessment and reported in the EIA Report.

[3] In August 2020 Defra released an update of their EFT (version 10.0), and associated tools, reflecting updates to underlying data including fleet composition and emissions factors. As EFT version 8.0.1 was extant at the time of the assessment, low concentrations of pollutant emissions are predicted in the study area, and this study is a comparative assessment of different options, the use of the updated tools and guidance would not materially alter the conclusions of this assessment. The most up to date version of EFT, and associated tools would be used during the DMRB Stage 3 assessment and reported in the EIA Report.

[4] DMRB HA 207/07 has been withdrawn. However, its use and relevance for this DMRB Stage 2 assessment is valid on the basis that no new traffic data has been provided and the updated guidance (DMRB LA 105) and supporting tools are not appropriate given they do not support the assessment of $PM_{2.5}$ and use updated emission factors and speed banding. The formula referenced in Annex C3.2 is also not published within DMRB LA 105, hence the reference to former guidance.

[5] In August 2020 Defra released an update of their NO_x to NO_2 tool (version 8.1), and associated tools, reflecting updates to underlying data as discussed in footnote 3. As version 6.1 was extant at the time of the assessment, low concentrations of pollutant emissions are predicted in the study area, and this study is a comparative assessment of different options, the use of the updated tools and guidance would not materially alter the conclusions of this assessment. The most up to date version of tools would be used during the DMRB Stage 3 assessment and reported in the EIA Report.

Tunnel (Option ST2A)/Underpass (Option ST2B) Modelling

15.2.18 The air quality impacts and effects of the tunnel/underpass designs were assessed by modelling emissions using IDA tunnel modelling software (IDA Tunnel[6]) for both the Option ST2A tunnel (which included turbine fans[7] used to pull the air from the tunnel entrances to the exits to assist the mixing of air within the tunnel) and the Option ST2B underpass. The concentrations at the tunnel/underpass exit/entrance were converted to a mass release rate and used as the emissions source within the ADMS-Roads dispersion model. The modelled concentrations were predicted using ADMS-Roads at all human health receptor locations and identified designated habitat transects within 200m of the tunnel/underpass exit/entrance. The ADMS-Roads modelled concentrations (results) for the tunnel/underpass exit /entrance, were then added to the road contributions from non-tunnel/underpass road links derived using the Simple Assessment approach (i.e. using the dispersion equations in DMRB HA 207/07) for each receptor, to provide a total modelled concentration. The total NO_x concentrations were converted to NO_2 using the NO_x/NO_2 calculator as described in paragraph 15.2.16.

Air Quality Receptors

Human Health Receptors

15.2.19 The assessment of potential impacts and effects on human health receptors considered concentrations of NO_2, PM_{10} and $PM_{2.5}$ at sensitive receptor locations for the proposed route options in the opening year (2026). These human health receptors are all classified as residential properties. These locations represent exposure to pollutants over the averaging periods of the relevant AQOs; 1 year, 1 day and 1 hour. Worst-case locations have been defined as those where people might experience the highest change and/or highest pollutant concentration and are presented in Table 15.2. These locations are also representative of other receptors within the study area. Figures 15.1 to 15.4 show the sensitive receptor locations in the context of each respective proposed route option (ST2A to ST2D).

Table 15.2: Sensitive Receptor Locations (Human Health Receptors)

Receptor No.	Receptor Location (OS Co-ordinates)		Description
	X (m)	Y (m)	
1	305666	739549	Roman Bridge Cottage, Ringwood, Birnam
2	304502	740202	Ringwood Cottage, Ringwood, Birnam
3	303623	741286	Craigbeithe, Birnam Glen, Birnam
4	303587	741469	6 Perth Road, Birnam, Dunkeld
5	303261	741774	St. Caens, Perth Road, Perth
6	303038	741614	Birnam Bank House, Birnam Glen, Birnam
7	302985	741831	51 Stell Park Road, Birnam, Dunkeld
8	302936	742012	30 Stell Park Road, Birnam, Dunkeld
9	302854	741931	9 Telford Gardens, Birnam, Dunkeld
10	302749	742008	Tianavaig, 12 King Duncan's Place, Birnam, Dunkeld
11	302718	742134	Park Cottage, Little Dunkeld, Dunkeld
12	302691	742275	Nursery Cottage, Little Dunkeld, Dunkeld

[6] https://www.equa.se/en/tunnel
[7] The fans are used to inject a longitudinally flow along the tunnel to allow pollution emitted by vehicles to be sufficiently diluted upon exit from the portals.

Receptor No.	Receptor Location (OS Co-ordinates)		Description
	X (m)	Y (m)	
13	302659	742270	Development at Bruce Gardens, Dunkeld
14	302637	741911	Braeknowe, Birnam, Dunkeld
15	302615	742271	Development at Bruce Gardens, Dunkeld
16	302600	742172	Corbiere, Little Dunkeld, Dunkeld
17	301580	742309	Auchlou Cottage, Inver, Dunkeld (excluded from impact assessment, as explained in paragraph 15.2.20)
18	301576	742172	Milltimber, Inver, Dunkeld
19	301574	742265	Sunnybank Cottage, Inver, Dunkeld
20	300608	744881	Woodlands, Ballinluig, Pitlochry
21	303084	741741	2 Station Cottages, Birnam, Dunkeld
22	303879	741234	Ballincreiff House, Birnam, Dunkeld
23	302539	742170	Craigvinean Medical Centre, Little Dunkeld
24	302118	741765	The Byre, Ladywell Farm, Dunkeld
25	300725	741494	Dundonnachie, Dunkeld

15.2.20 The air quality modelling has been undertaken based on the DMRB Stage 2 proposed route option designs. All proposed route options include the demolition of Auchlou (receptor 17). This has therefore been excluded from the impact assessment as the receptor would not exist once the A9 has been dualled.

Designated Habitats

15.2.21 High concentrations of NO_x can have an adverse effect on certain types of vegetation, and DMRB LA 105 states that designated habitats should be identified and assessed as part of the air quality assessment. Sites that should be considered are those for which the designated features are sensitive to air pollutants. These include 'Ramsar' sites, Special Areas of Conservation (SAC), Special Protection Areas (SPA), Sites of Special Scientific Interest (SSSI), Local Nature Reserves (LNR), local wildlife sites, nature improvement areas, ancient woodlands (as identified in the Ancient Woodland Inventory (AWI)) and veteran trees. The quantification of air quality impacts on designated habitats considers nutrient nitrogen deposition at worst-case locations within designated sites. Worst-case locations are defined as those that may experience the highest change and/or highest pollutant concentration and are typically at the designated habitat boundary.

15.2.22 The Air Pollution Information System (APIS) has been used along with professional judgement by an ecologist to consider whether any designated site identified would be sensitive to nitrogen deposition as further discussed in Section 15.3 (Baseline Conditions). Reference is also made to Volume 1, Part 3 – Environmental Assessment (Chapter 11: Biodiversity, Section 11.3 (Baseline Conditions)) for a wider discussion on designated habitats.

15.2.23 Four ancient woodlands and the River Tay SAC were identified within 200m of affected road links (ancient woodland sites: 1a; 2b; 2a; 1a and 2a). These sites are presented in Table 15.3 and their location shown on Figures 15.5 to 15.8 (the River Tay SAC was not assessed on the basis that it is not sensitive to nitrogen. The transects developed for the River Tay SAC have subsequently not been modelled. These are included in Table 15.3 to clarify the Receptor Transect Figure ID assigned to the remaining designated habitats. Whilst only four designated ancient woodland sites have been identified they span a large area and are within 200m of different affected road links. A total of 20 transects have been considered to provide a representative assessment of ancient woodland in this area. Points within each transect, have been assessed at 10m intervals up to 200m back from the habitat boundary, closest to the road source. The transect modelled point ID refers to the closest point of a given transect (i.e. at the designation site boundary) to the nearest road link. The co-ordinates of these closest points are presented in Table 15.3.

Table 15.3: Sensitive Receptor Locations (Ecological Receptors)

Receptor Transect Figure ID[1]	Transect Modelled Point ID[1,2]	OS Co-ordinates		Designated Site ID Description[3]	Designation
		X(m)	Y(m)		
A, B, C, D, E, F	Site not sensitive to nitrogen deposition, therefore not modelled	Whole length of proposed route options.		River Tay	SAC
A1	ECO_A1_01	300441	743791	1a, Ancient semi-natural	Ancient woodland
G	ECO_G_01	305887	739464	2b, Long Established Plantation Origin	Ancient woodland
H	ECO_H_01	305882	739425	1a, Ancient semi-natural	Ancient woodland
I	ECO_I_01	305017	739760	1a, Ancient semi-natural	Ancient woodland
J	ECO_J1_02	304605	740224	2b, Long Established Plantation Origin	Ancient woodland
J	ECO_J2_01	304497	740283	2b, Long Established Plantation Origin	Ancient woodland
K	ECO_K_01	303595	741389	2a, Ancient semi-natural	Ancient woodland
L	ECO_L_01	303986	740725	2b, Long Established Plantation Origin	Ancient woodland
M	ECO_M_01	302895	741752	2b, Long Established Plantation Origin	Ancient woodland
N	ECO_N_01	302505	742039	2a, Ancient semi-natural	Ancient woodland
O	ECO_O_01	300539	742482	1a, Ancient semi-natural	Ancient woodland
P	ECO_P_01	300231	743135	1a, Ancient semi-natural	Ancient woodland
Q	ECO_Q_00	300331	743700	1a, Ancient semi-natural	Ancient woodland
R	ECO_R_01	300439	743667	1a and 2a	Ancient woodland
U	ECO_U_21	305794	739412	1a, Ancient semi-natural	Ancient woodland
V	ECO_V_01	304977	739732	1a, Ancient semi-natural	Ancient woodland
W	ECO_W_00	304119	740884	2b, Long Established Plantation Origin	Ancient woodland
X	ECO_X_01	301053	742338	2a, Ancient semi-natural	Ancient woodland
Y	ECO_Y_01	300390	742767	2a, Ancient semi-natural	Ancient woodland
Z	ECO_Z_01	300405	743499	2a, Ancient semi-natural	Ancient woodland

Note 1: Missing transect IDs ((A,B,C,D,E,F -River Tay)(S and T-native woodlands)) relate to locations identified and not assessed as not sensitive to nitrogen deposition or removed as less representative compared to other transect IDs. Numerals following a transect ID letter, relate to additional transects in a location (e.g. J1, J2 and A1)
Note 2: Located at the receptor boundary i.e. the closest point to an affected road link
Note 3: Description sourced from Ancient Woodland Inventory database (NatureScot, 2021a).

Baseline Conditions

Desk-based Assessment

15.2.24 A desk-based review of the available air quality information was undertaken. As the study area falls within Perth & Kinross Council (PKC), information, including monitoring data from the local air quality management annual progress report produced by PKC over the past five years, were reviewed as part of the desk-based assessment. Scottish Government and Defra background maps were also reviewed to establish an understanding of the baseline conditions. The sources of baseline information used in the DMRB Stage 2 assessment are reported in Table 15.4.

Table 15.4: Sources of Baseline Information

Information Source	Reference
Scottish Government	Local Air Quality Management 1km x 1km grid background pollutant maps (Scottish Government, 2018a)
Department for the Environment Food and Rural Affairs (Defra)	Interactive Monitoring Networks Map (Defra, accessed 2018a)
	Local Air Quality Management 1km x 1km grid background pollutant maps (Defra, 2018b)
NatureScot	NatureScot Information service, Sitelink. Available at: https://sitelink.nature.scot/home (accessed 2020)
PKC	Annual Progress Report (PKC, 2020)
Air Pollution Information System	Critical loads and background N-depositions for designated sites www.apis.ac.uk (Accessed April 2020)
Air Quality in Scotland	Air Quality Management Areas locations www.scottishairquality.co.uk

Air Quality Monitoring

15.2.25 A six-month period programme of NO_2 concentration monitoring was undertaken using diffusion tubes between February and August 2015 for the A9 Dualling Southern Section Projects. A total of 26 locations were chosen for monitoring. One co-location site (at Atholl Street, Perth continuous monitoring station, for bias adjustment purposes) and 25 sites positioned along the four A9 Dualling Programme projects between Pass of Birnam and Glen Garry, which included roadside and sensitive receptor locations. Within the Pass of Birnam to Tay Crossing project, there were three monitoring locations within the study area.

15.2.26 Monitoring results were annualised to estimate the annual mean NO_2 concentrations at each monitoring location following guidance in LAQM.TG(16). The verification process was undertaken according to LAQM.TG(16) and is detailed in Annex E of *Appendix A15.1: Air Quality Annexes*. Model performance statistics show that the uncertainty in the predictions of adjusted total annual mean NO_2 was acceptable, as the Root Mean Square Error (RMSE) is less than 2 $\mu g/m^3$.

15.2.27 The diffusion tube monitoring locations within the study area were unsuitable for verification purposes (site 1 was positioned at a road junction and sites 2 and 3 at bus stop locations) as presented in Table 3, Annex C of *Appendix A15.1: Air Quality Annexes*. No further consideration was given to these sites.

Consultation

15.2.28 A summary of the consultation is reported in Volume 1, Part 3 – Environmental Assessment (Chapter 7: Overview of Environmental Assessment, Section 7.6 (Consultation)). Key consultations that have informed this assessment are summarised in the following paragraph.

15.2.29 PKC was consulted on the site selection for diffusion tubes. Information was also requested on any existing air quality monitoring locations, in addition to those referenced in the 2015 Air Quality Progress Report for PKC, within 1km of the existing A9 in a consultation letter sent on 23 March 2015.

Assessment of Impacts and Effects

15.2.30 Assessment of potential impacts and significance of effects was determined in accordance with DMRB LA 105. The assessment of the significance of effects on air quality considers areas where AQOs might be expected to be exceeded; this includes Air Quality Management Areas (AQMAs). The presence or absence of an AQMA within a study area is not the sole focus of a judgement of a proposed route option's significance; it is however a factor that is taken into account.

15.2.31 There are no AQMAs within the study area relevant to this assessment, as discussed further in paragraphs 15.3.4 and 15.3.5.

Air Quality Thresholds

15.2.32 The assessment of potential impacts and effects on local air quality considers the relevant air quality legislation and guidance provided in DMRB LA 105, considering the Limit Values set out in the EU Directive on Ambient Air Quality and AQOs applicable to LAQM in Scotland, as set out in the Air Quality (Scotland) Regulations 2000 (Scottish SI 2000 No.97). These are detailed in Annex A of *Appendix A15.1: Air Quality Annexes*. Relevant planning policy in relation to air quality is considered at the national and local level and is discussed in Volume 1, Part 3 – Environmental Assessment (Chapter 21: Policies and Plans).

15.2.33 Table 15.1 lists the key traffic related annual mean air quality thresholds which have the same concentrations and measurement period for relevant national air quality regulations and EU Directive on ambient air quality. These threshold values are set with reference to human health and designated habitats as appropriate.

15.2.34 Requirements for assessing $PM_{2.5}$ are not included in DMRB LA 105 and no significance criteria are provided. However, in Scotland there is a $PM_{2.5}$ AQO, and to enable consideration of $PM_{2.5}$ this assessment therefore the relevant percentages have been applied for $PM_{2.5}$, refer to Table 15.5.

Critical Loads

15.2.35 APIS holds site specific information about the sensitivity of a site, its existing pollutant concentrations and deposition rates and the Critical Loads assigned to specific habitats or features. The Critical Loads are a measure above which a habitat or species may be adversely impacted. Existing deposition rates and appropriate Critical Loads for each of the transect locations assessed at DMRB Stage 2 are reported in Table 15.8.

Importance/Sensitivity

15.2.36 All human health receptors and designated habitats are considered to be of equal value in terms of the air quality assessment. Representative receptors (Tables 15.2 and 15.3) were identified for the purposes of assessment and reporting, as shown on Figures 15.1 to 15.4 for human health receptors and Figures 15.5 to 15.8 for designated habitats.

Magnitude of Impact

15.2.37 Table 15.5 provides the magnitude of change criteria (magnitude of impact) for relevant air pollutants assessed in this chapter and their respective air quality threshold.

Table 15.5: Air Quality Magnitude of Change Criteria

Magnitude of Change	Value of Change in Annual Average NO_2, PM_{10} and $PM_{2.5}$ Concentration
Large	Greater than 10% of the AQO.
Medium	Greater than 5% but less than or equal to 10% of the AQO
Small	More than 1% but less than or equal to 5% of the AQO
Imperceptible	Less than or equal to 1% of the AQO

15.2.38 These magnitude of change criteria were applied to the modelling results for human health receptors and designated habitat receptors. This has been applied separately for each pollutant/air quality threshold.

Significance of Effect

15.2.39 The approach to the consideration of potential impacts and the potential for significant effects during the operation phase is outlined in the following paragraphs. The assessment of the potential for significant effects includes embedded mitigation (design measures which are integrated into a project for the purpose of minimising environmental effects).

Human Health Receptors

15.2.40 Where the assessment predicted that modelled concentrations at all selected sensitive receptors are less than the air quality thresholds; or where any changes above the air quality threshold had a magnitude of change of Imperceptible, it has been considered that the proposed route option potential effect on human receptors is 'not significant'.

15.2.41 Any predicted changes in concentration greater than Imperceptible were assigned to one of six categories (Large, Medium and Small for Worsening or Improvement) for each sensitive receptor.

15.2.42 The number of receptors for each category were then compared to guideline ranges provided in DMRB LA 105. Where the number of receptors in each category are equal to or less than the lower limit of a given category, it has been considered likely that the potential effect of the proposed route option is 'not significant'; where values are equal to or greater than the upper limit of the range for a given category it has been considered that the potential effect of the proposed route option is 'significant'. Where values lie between the guideline range for a given category, it has been considered that the potential effect of the proposed route option could be 'significant' and professional judgement has been applied to assess the overall effect.

15.2.43 Greater significance has been attributed to magnitudes of change predicted to be above the air quality thresholds, and to predicted exceedances of short-term air quality thresholds than long-term exceedances.

15.2.44 The outcome of the EU Directive compliance risk assessment, as set out in DMRB LA 105, has also been used to inform the judgement of overall significance of effect for the proposed route options. Where a proposed route option is assessed as a high risk of non-compliance, it has been considered more likely to lead to a potentially 'significant' overall effect; whereas if the proposed route option is assessed as a low risk of non-compliance, it has been considered likely to be 'not-significant'.

Designated Habitats

15.2.45 Where the total nitrogen deposition with the project is less than the lower applicable Critical Load (CL) or the change in nitrogen deposition is less than one percent of the lower Critical Load, for all designated habitat sites the proposed route option potential effect is 'not significant'. Where the change in deposition rate is 1% or above the CL for a particular site, the impact is potentially significant and the nutrient nitrogen deposition rates would be used within Chapter 11 (Biodiversity) to determine the significance of effects, in accordance with DMRB LA 105, section 2.97 and Figure 2.98.

15.2.46 It is not possible to determine the significance of effects as per Figure 2.98 due to site specific ecological survey data being unavailable at DMRB Stage 2. The magnitudes of change are presented in this report as indicative of the potential for impacts and to support the identification of a differentiator between proposed route options.

Community Objectives

15.2.47 At an early stage in the A9 Co-Creative Process, the Birnam to Ballinluig A9 Community Group generated community objectives. The seven community objectives are presented in Volume 1, Part 3 – Environmental Assessment (Chapter 7: Overview of Environmental Assessment) and cover a wide range of topics but focus predominantly on environmental issues.

15.2.48 The Community Objectives have been taken into consideration throughout the DMRB Stage 2 process and a mapping exercise was conducted to indicate how, in the operational phase, the proposed route options could contribute to the relevant objectives. Details of how each environmental topic contributes towards achieving the community objectives is presented in *Appendix A7.1: Mapping of Community Objectives Against DMRB Stage 2 Route Options* and a summary for this chapter is presented in Section 15.6 (Summary of Route Options Assessment).

Limitations to Assessment

15.2.49 It should be noted that this DMRB Stage 2 assessment was prepared prior to and during the global COVID-19 coronavirus pandemic. Throughout 2020 and in early 2021, there have been significant and extensive restrictions in place in Scotland on the movement of people and the activities that are permitted. Due to the duration and extent of such restrictions, some of the baseline and survey updates have not been achievable.

15.2.50 At this stage, the information on construction activities and construction traffic are available in limited quantities. Consequently, and in accordance with DMRB LA 105, the effect of additional construction traffic has been considered qualitatively and a differential impact on receptors could not be assessed. These limitations are typical of a DMRB Stage 2 assessment, and the assessment reported in this chapter is considered robust, of an appropriate level of detail, and in line with the DMRB guidance. Further work should be undertaken during the DMRB Stage 3 assessment to inform the design of the Preferred Route Option.

15.2.51 At DMRB Stage 2, detailed survey information was not available to establish the conditions at each of the designated habitat sites to allow a full determination of significance. Areas identified as showing potential for impacts at DMRB Stage 2 should be considered further at DMRB Stage 3.

15.3 Baseline Conditions

Baseline Air Quality

Background Pollutant Concentrations

15.3.1 Background annual mean pollution concentration estimates for the base year, and assessment years are presented in Table 15.6. Adjustment of the mapped backgrounds by comparison to monitored backgrounds was not undertaken and is discussed further in Annex C of *Appendix A15.1: Air Quality Annexes*.

15.3.2 As the background NO_x and PM_{10} maps provide data for individual pollutant sectors (e.g. motorway, trunk A-roads, primary A-roads, minor roads and industry), the components relating to road traffic that were explicitly modelled (Motorway, Trunk and A roads) have been removed, to avoid double counting of road emissions for the prediction of pollutant concentrations.

Table 15.6: Average Mapped Background Annual Mean Pollutant Concentrations (Sector removed)

Pollutant	Mapped Background Concentrations (µg/m³)		Limit Value /Objective Threshold (µg/m³)
	2015	2026	
NO_x	4.5	2.9	30
NO_2	3.6	2.3	40
PM_{10}	7.2	6.8	18
$PM_{2.5}$	4.0	3.7	10

15.3.3 As explained previously, UK and EU threshold values are set for each pollutant to protect human health or designated habitats. Table 15.6 shows background annual mean pollutant concentrations for all assessment years are well below threshold values (less than 75% of AQOs).

Perth & Kinross Council: Local Air Quality Management

15.3.4 PKC has declared two AQMAs for an area which encompasses the main built-up area of Perth and Crieff. The Perth AQMA was declared in 2006 for exceedances of annual mean objectives for NO_2 and PM_{10} and an Air Quality Action Plan (AQAP) was prepared in 2009 and is currently under review to be completed 2020/2021. The Crieff AQMA was declared in 2014 for exceedances of annual mean objectives for NO_2 and PM_{10}. The Crieff AQAP was approved in 2019 and implantation of agreed measures will be progressed through consultation with the local community, internal and external stakeholders.

15.3.5 The 2020 APR reported a downward trend in annual mean NO_2 concentrations and 2019 was the first year since monitoring began that no exceedances were measured at either AQMA. Measured levels of PM_{10} during 2019, were reported to have decreased and $PM_{2.5}$ monitoring, measured no exceedances of objective levels either, indicating that neither AQMA required amending to include $PM_{2.5}$.

15.3.6 The AQMAs are located approximately 13km south and 23km south-west of the study area, and as they are unlikely to be influenced by changes to traffic as a consequence of this project, they have been scoped out of further assessment. It is also considered that the proposed route options would have no influence on the AQAP implementation.

15.3.7 PKC operated a network of 74 diffusion tubes across the local authority area during 2019. The network of diffusion tubes is broken down into the following areas: Perth City Centre and wider area, Crieff, Kinross, Auchterarder, Coupar Angus and Blairgowrie.

15.3.8 The closest PKC diffusion tubes are located in Main Road, Ballinluig, which are approximately 8km from the proposed route options. Therefore, based on the distance from the proposed route options these PKC diffusion tubes are not considered to be representative of local conditions (at the commencement of the DMRB Stage 2 assessment).

Additional Survey Work

15.3.9 NO_2 diffusion tube monitoring was undertaken over a period of six months in accordance with the Defra guidance 'Diffusion Tubes for Ambient NO_2 Monitoring: Practical Guidance (2008)'. Three monitoring locations were chosen for this project (locations 1, 2 and 3). The details of monitoring sites for the proposed route options are presented in Table 15.7 and shown on Figure 15.9. Table 3, Annex C of *Appendix A15.1: Air Quality Annexes* provides additional information on the project specific monitoring undertaken.

Table 15.7: Jacobs NO_2 Diffusion Tube Monitoring

Name	OS Coordinates		Height (m)	Type	Estimated Monitored Annual Mean NO_2 Concentration (µg/m^3) *
	X (m)	Y (m)			
Location 1	301794	742051	2.3	Background	5.1
Location 2	301716	742296	2.8	Kerbside	30.3
Location 3	301627	742283	2.9	Kerbside	**44.2**

*Exceedance is highlighted in **Bold and Underline**

15.3.10 Monitoring results indicate the annual mean NO_2 objective is met at Location 1 and 2. The annual mean NO_2 objective is exceeded at Location 3, however, this location is not representative of a sensitive human health receptor for an annual average as it is a kerbside site (i.e. it is unlikely that someone would be standing in that location for the majority of a year). Raw monitoring results used to generate Table 15.7 above are provided in Annex C of *Appendix A15.1: Air Quality Annexes.*

Identification of Trends

15.3.11 A trend identified in the mapped background concentrations indicates a reduction in forecast pollutant concentrations from the base year of 2015 to the 2026 opening year to one decimal place.

15.3.12 As a conservative approach, modelling results for NO_x and NO_2 have been adjusted using Long Term Gap Analysis (outlined within DMRB LA 105 (Highways England et al, 2019)), using the projection factors that incorporate the Euro 6/VI improvements, known as 'LTTE6'.

Pollution Climate Mapping Model

15.3.13 The study area was reviewed against Defra's Pollution Climate Mapping Model (PCM). No PCM model links were identified within the study area. The closest PCM road links are located around Perth (over 14km from the proposed route options) and include the A912, A93 and the A94. The highest roadside contribution for the opening year is 15.3 µg/m^3 for the A912, which is well below the AQO. Consequently, the proposed scheme would not have an effect on Defra or the Scottish Government's achievement of EU Limit Values.

Sensitive Receptor Locations

15.3.14 The proposed route options pass through the populated areas of Little Dunkeld and Birnam, between the River Tay and the existing A9. Beyond Dunkeld, the human health receptors are sparse. Table 15.2 lists the human health receptors identified as representative worst-case receptors for the assessment. These locations are also shown on Figures 15.1 to 15.4.

Designated Habitats

15.3.15 The River Tay SAC, (as shown on Figures 11.1 and 11.2), which is also discussed in detail in Volume 1, Part 3 – Environmental Assessment (Chapter 11: Biodiversity) has been considered by this air quality assessment.

15.3.16 The River Tay SAC may be nitrogen sensitive due to permanent oligotrophic waters. However, nitrogen inputs from catchment land-use, not nitrogen deposition from the atmosphere, are likely to be much more relevant contributors (Strong et al., 1997; Smith and Stewart, 1989; Foy et al., 1982). APIS indicates that, in 2012, the source contribution of nitrogen to the River Tay SAC from Scottish road transport (i.e. atmospheric nitrogen deposition from NO_x emissions) was 3.2% with the dominant contribution being livestock production (Scottish sources contributing seventeen times more than that from Scottish road transport). Consequently, APIS recommends that site specific advice should be sought on determining sensitivity to nitrogen, and decisions should be taken at a site-specific level, considering other sources of nitrogen, for example, discharges to water and diffuse agricultural pollution.

15.3.17 Technical discussions between air quality and ecology professionals were held and it was concluded that, given the total contribution to nitrogen deposition from Scottish road transport on the River Tay SAC is 0.9 kg N/ha/yr (APIS, 2020), changes in road transport NO_x concentrations due to the proposed scheme were unlikely to give rise to significant impacts given Scottish road transport's small overall influence (3.2%) on total nitrogen at the site. The River Tay SAC was therefore scoped out of further assessment with respect to nitrogen deposition.

15.3.18 The ancient woodland designated sites presented in Table 15.3 have the potential to include nitrogen sensitive features, therefore nitrogen deposition calculations have been undertaken, in line with DMRB LA 105. Table 15.8 presents the site-specific details and Critical Loads. Where a transect includes more than one habitat (of the same vegetation type), the most stringent lower Critical Load has been applied.

15.3.19 It is noted that existing deposition rates at all transects assessed, are above the respective Critical Loads for their respective habitat.

Table 15.8: Habitat Specific Critical Loads and Existing Deposition Rates

Transect ID	Transect Point ID	Habitat 1	Habitat 2	Lower Range CL (kgN/ha/yr)	Existing Deposition Rate (KgN/ha/yr)
		(UNECE Critical Load range) kgN/ha/yr			
A1	ECO_A1_01	Broadleaved deciduous woodland (10-20)	N/A	10	13.3
G	ECO_G_01	Mixed - Broadleaved deciduous woodland (10-20)	N/A	10	14.14
H	ECO_H_01	Broadleaved deciduous woodland (10-20)	N/A	10	14.14
I	ECO_I_01	Mixed - Broadleaved deciduous woodland (10-20)	Acidophilous Quercus-dominated woodland (10-15)	10	14
J1	ECO_J1_02	Coniferous woodland (5-15)	Broadleaved deciduous woodland (10-20)	5	13.3
J2	ECO_J2_01	Coniferous woodland (5-15)	Broadleaved deciduous woodland (10-20)	5	13.3

Transect ID	Transect Point ID	Habitat 1	Habitat 2	Lower Range CL (kgN/ha/yr)	Existing Deposition Rate (KgN/ha/yr)
		(UNECE Critical Load range) kgN/ha/yr			
K	ECO_K_01	Broadleaved deciduous woodland (10-20)	N/A	10	13.3
L	ECO_L_01	Broadleaved deciduous woodland (10-20)	N/A	10	13.3
M	ECO_M_01	Broadleaved deciduous woodland (10-20)	Coniferous woodland (5-15)	5	13.3
N	ECO_N_01	Acidophilous Quercus-dominated woodland (10-15)	N/A	10	13.3
O	ECO_O_01	Coniferous woodland (5-15)	N/A	5	13.3
P	ECO_P_01	Coniferous woodland (5-15)	N/A	5	13.3
Q	ECO_Q_00	Coniferous woodland (5-15)	Mixed - Broadleaved deciduous woodland (10-20)	5	13.3
R	ECO_R_01	Coniferous woodland (5-15)	Broadleaved deciduous woodland (10-20)	5	13.3
U	ECO_U_21	Coniferous woodland (5-15)	N/A	5	14.14
V	ECO_V_01	Coniferous woodland (5-15)	N/A	5	14.14
W	ECO_W_00	Broadleaved deciduous woodland (10-20)	N/A	10	13.3
X	ECO_X_01	Broadleaved deciduous woodland (10-20)	Coniferous woodland (5-15)	5	13.3
Y	ECO_Y_01	Mixed - Broadleaved deciduous woodland (10-20)	N/A	10	13.3
Z	ECO_Z_01	Broadleaved deciduous woodland (10-20)	N/A	10	13.3

Note 1 United Nations Economic Commission for Europe.

15.4 Potential Impacts and Effects

Construction

15.4.1 There are 381 sensitive receptors identified within 200m of the combined boundary of the Do-minimum (DM) and Do-something (DS) (all proposed route options) which are likely to be affected during construction.

15.4.2 Receptors within 50m of the principal dust generating activities (e.g. site clearance, topsoil strip; cutting and filling, handling and placing of road base materials and aggregates and landscaping) and downwind of the prevailing south-west winds would be those potentially at greatest risk of nuisance associated with construction-related dust. Option ST2A and Option ST2B (tunnel and underpass) would require a greater level of earthworks and construction and are likely to be high risk for generating dust compared to Options ST2C and ST2D. Option ST2A is likely to require more earthworks and construction than Option ST2B. With the implementation of appropriate mitigation and best practice techniques, potential effects from construction activities are anticipated to be 'not significant' for all proposed route options.

15.4.3 The risk of potential effects to human health from PM_{10} at receptors close to construction related activities is expected to not be significant for all proposed route options with appropriate mitigation in place. The background pollution concentrations are below AQOs for construction related impacts to cause potentially significant effects.

15.4.4 DMRB LA 105 states that where construction is expected to last for more than two years, the traffic management measures, and the effect of the additional construction vehicles should also be assessed as an additional scenario. However, at this stage of the assessment, traffic data are not available for the construction phase. Considering the likely numbers of construction vehicles and the low background concentrations within the study area, it is unlikely that the potential impacts related to construction traffic would have a significant effect on air quality. This would be considered in more detail at DMRB Stage 3 for the Preferred Route Option.

Operation

Human Health Receptors

15.4.5 The full assessment results at human health receptors with the greatest magnitude of change for each proposed route option, and the potential impact summary are presented in Annex E of *Appendix A15.1: Air Quality Annexes*. Tables 15.9, 15.10 and 15.11 provide a summary of the findings of the assessment.

Table 15.9: Summary of Annual Mean NO_2 Concentration Impacts at Human Health Receptors that show the minimum or maximum annual mean and greatest changes between DM and DS (Objective 40 µg/m^3)

	Annual Mean NO_2 Concentration (µg/m^3)					*Greatest changes between DM and DS proposed route options (µg/m^3) across all receptors			
	DM	Option ST2A	Option ST2B	Option ST2C	Option ST2D	Option ST2A	Option ST2B	Option ST2C	Option ST2D
Min*	2.7	3.0	2.9	2.8	2.9	-2.1	-2.0	-0.7	-2.0
Max*	16.3	16.1	29.4	19.1	17.5	5.7	13.0	5.5	3.4
Average	6.6	7.3	7.8	7.9	7.2	0.7	1.2	1.3	0.6
	Exceedance of the objective?					Magnitude of Averaged Change			
	No	No	No	No	No	S	S	S	S
						S = Small; M = Medium; L = Large			
	Note: * Reported values are for different receptor locations for the min and max concentrations and also the greatest change columns								

Table 15.10: Summary of Annual Mean PM_{10} Concentration Impacts at Human Health Receptors that show the minimum or maximum annual mean and greatest changes between DM and DS (Objective 18 µg/m³)

	Annual Mean PM_{10} Concentration (µg/m³)					* Greatest changes between DM and DS proposed route options (µg/m³) across all receptors			
	DM	Option ST2A	Option ST2B	Option ST2C	Option ST2D	Option ST2A	Option ST2B	Option ST2C	Option ST2D
Min*	6.3	6.4	6.4	6.4	6.4	-0.3	-0.3	-0.1	-0.3
Max*	9.0	8.9	10.0	9.1	8.8	0.6	1.0	0.7	0.5
Average	7.6	7.6	7.6	7.7	7.6	0.08	0.06	0.13	0.00
	Exceedance of the objective?					Magnitude of Averaged Change			
	No	No	No	No	No	I	I	I	I
						I = Imperceptible; S = Small; M = Medium			
	Note: * Reported values are for different receptor locations for the min and max concentrations and also the greatest change columns								

Table 15.11: Summary of Annual Mean $PM_{2.5}$ Concentration Impacts at Human Health Receptors that show the minimum or maximum annual mean and greatest changes between DM and DS (Objective 10 µg/m³)

	Annual Mean $PM_{2.5}$ Concentration (µg/m³)					* Greatest changes between DM and DS proposed route options (µg/m³) across all receptors			
	DM	Option ST2A	Option ST2B	Option ST2C	Option ST2D	Option ST2A	Option ST2B	Option ST2C	Option ST2D
Min*	3.5	3.5	3.5	3.5	3.5	-0.2	-0.2	-0.1	-0.2
Max*	5.0	5.3	6.1	5.0	4.8	1.1	1.1	0.4	0.3
Average	4.1	4.2	4.2	4.2	4.1	0.09	0.07	0.07	0.00
	Exceedance of the objective?					Magnitude of Averaged Change			
	No	No	No	No	No	I	I	I	I
						I = Imperceptible; S = Small; M = Medium			
	Note: * Reported values are for different receptor locations for the min and max concentrations and also the greatest change columns								

15.4.6 The assessment indicates increased pollutant concentrations (i.e. adverse potential effect) at some human health receptor locations and decreased pollutant concentrations at others (i.e. beneficial potential effect), depending on the proposed route option. Adverse potential effects are typically caused by an overall increase in number of vehicles or number of HDVs, decreased vehicle speeds or moving a road closer to a receptor. Conversely, beneficial potential effects are typically caused by overall decreases in the number of vehicles or number of HDVs, increased vehicle speeds or moving a road away from a receptor.

15.4.7 There are no predicted exceedances of annual mean NO_2, PM_{10} and $PM_{2.5}$ objectives, nor the 1-hour mean NO_2 and 24-hour mean PM_{10} with any of the proposed route options at sensitive receptors. The highest concentrations are predicted at the receptors nearest the underpass exits (Option ST2B).

15.4.8 For all proposed route options, no human health receptors are predicted to receive a worsening of an AQO exceedance or a creation of a new exceedance for either annual mean NO_2 or PM_{10} in accordance with DMRB LA 105. All proposed route options are predicted to have no exceedances for annual mean $PM_{2.5}$ concentrations.

15.4.9 Table 15.12 provides a summary of the annual mean NO_2 magnitude of change impacts for each proposed route option. The impact magnitude terms describe the scale of change between the DM and DS scenarios and are not an indicator of the significance of potential effects which is considered later in this assessment (refer to paragraph 15.4.38. A full breakdown of human health receptor results is provided in Annex E of *Appendix A15.1: Air Quality Annexes*.

Table 15.12: Annual Mean NO_2 Air Quality Human Health Impact Summary

Receptor	Option ST2A	Option ST2B	Option ST2C	Option ST2D
1	Imperceptible	Small	Small	Small
2	Medium	Medium	Medium	Medium
3	Small	Small	Small	Small
4	Small	Medium	Large	Medium
5	Imperceptible	Imperceptible	Imperceptible	Imperceptible
6	Small	Medium	Small	Small
7	Imperceptible	Small	Medium	Small
8	Small	Imperceptible	Imperceptible	Imperceptible
9	Large	Imperceptible	Small	Imperceptible
10	Imperceptible	Small	Small	Small
11	Small	Small	Imperceptible	Small
12	Imperceptible	Imperceptible	Medium	Imperceptible
13	Imperceptible	Imperceptible	Medium	Imperceptible
14	Small	Small	Small	Small
15	Imperceptible	Small	Small	Small
16	Medium	Small	Small	Medium
17	-	-	-	-
18	Imperceptible	Imperceptible	Imperceptible	Imperceptible
19	**Large**	Medium	Small	Medium
20	Imperceptible	Imperceptible	Small	Imperceptible
21	Small	Large	Medium	Small
22	Small	Small	Medium	Small
23	Small	Small	Small	Small
24	Imperceptible	Imperceptible	Imperceptible	Imperceptible
25	Small	Small	Imperceptible	Small
Overall	**Small**	**Small**	**Small**	**Small**

Green shading = beneficial; Orange shading = adverse

15.4.10 All proposed route options are anticipated to increase NO_2 concentrations at human health receptors 1-4, 6, 7, 11, 14, 18-20, 22 and 24-25 with magnitude of impact ranging from Imperceptible to Large. The worsening of annual mean NO_2 concentrations are likely due to there being a higher volume of traffic, and subsequent emissions, potentially closer to human health receptors. However, the potential for AQO exceedances is not expected.

15.4.11 All proposed route options are anticipated to reduce NO_2 concentrations at human health receptors 16 and 23, with potential magnitude of impact ranging from Small to Medium. The potential for reduction of pollutant concentrations is likely due to the reduction in emission exposure at the human health receptors where the proposed route options are further from receptors and there is a change in traffic movements (i.e. traffic using alternative routes).

15.4.12 Receptors 9 and 19 are anticipated to result in increases of NO_2 concentrations with a potential impact of Large magnitude for Option ST2A, due to the effect of the emissions from the tunnel being pushed by the turbines towards the northbound exit of the tunnel running adjacent to Dunkeld (Receptor 9) and the close proximity of Receptor 19 to the proposed route option main alignment and increased emissions as a result of higher traffic flows. Although the potential magnitude of NO_2 increase is assessed as Large, the total concentrations are below the NO_2 objectives. Other locations, such as around human health receptor 21, have reduced concentrations as the emissions released close to these receptors are now enclosed within the proposed tunnel.

15.4.13 Option ST2B is anticipated to result in an increase of NO_2 concentrations at human health receptor 21 with a potential impact of Large magnitude, due to the effect of the underpass section of the lowered main alignment where it passes Dunkeld & Birnam Station and increased emissions as a result of higher traffic flows. Although the potential magnitude of NO_2 increase is assessed as Large, the total concentrations are below the NO_2 objectives.

15.4.14 Option ST2C is anticipated to result in an increase of NO_2 concentrations at human health receptor 4 with a potential impact of Large magnitude, which is likely a result of the emissions from traffic on the main alignment moving closer to receptors in combination with a change in volume of traffic. However, the total concentrations are below the respective NO_2 objectives.

15.4.15 There are no anticipated increases in NO_2 concentrations of Large magnitude for Option ST2D at any of the human health receptors considered.

15.4.16 Overall, the proposed route options are anticipated to result in the potential for small magnitude impacts in annual mean NO_2 concentrations. There are no exceedances of the NO_2 objectives as a result of the proposed route options.

15.4.17 Table 15.13 provides a summary of the annual mean PM_{10} potential impact magnitudes calculated for each proposed route option. As noted in paragraph 15.4.9, the potential impact magnitude terms describe the scale of change between the DM and DS scenarios and are not an indicator of potential significance of effect, which is considered later in this assessment (refer to paragraph 15.4.38. A full breakdown of human health receptor results is provided in Annex E of *Appendix A15.1: Air Quality Annexes*.

Table 15.13: Annual Mean PM_{10} Air Quality Human Health Impact Summary

Receptor	Option ST2A	Option ST2B	Option ST2C	Option ST2D
1	No change	No change	Imperceptible	No change
2	Small	Small	Small	Small
3	Small	Imperceptible	Imperceptible	Imperceptible
4	Imperceptible	Imperceptible	Small	Imperceptible
5	Imperceptible	Imperceptible	No change	No change
6	Small	Small	Small	Small
7	No change	Imperceptible	Imperceptible	Imperceptible
8	Small	No change	No change	Imperceptible
9	Small	Imperceptible	No change	Imperceptible
10	No change	Small	Imperceptible	Small
11	Small	Small	No change	Small
12	No change	No change	Small	No change
13	No change	Imperceptible	Small	Imperceptible
14	Small	Small	Small	Small
15	Imperceptible	Imperceptible	Imperceptible	Imperceptible
16	Small	Small	Imperceptible	Small
17	No change	No change	No change	No change
18	No change	No change	No change	No change
19	Small	Imperceptible	Imperceptible	Imperceptible
20	No change	No change	No change	No change
21	Imperceptible	Medium	Imperceptible	Small
22	No change	Imperceptible	Small	Imperceptible
23	Small	Small	Imperceptible	Small
24	No change	No change	No change	No change
25	Imperceptible	Imperceptible	Imperceptible	Imperceptible
Overall	**Small**	**Imperceptible**	**Imperceptible**	Small

Green shading = beneficial; Orange shading = adverse

15.4.18 All proposed route options are anticipated to increase PM_{10} concentrations at human health receptors 2-4, 6,14, and 25 with potential magnitude of impact ranging from Imperceptible to Small; the worsening of annual mean PM_{10} concentrations are likely due to the proposed route options bringing higher volumes of traffic and therefore emissions closer to human health receptors. However, no AQO exceedances are expected. All proposed route options are anticipated to reduce PM_{10} concentrations at human health receptors 16 and 23 with potential magnitudes between Imperceptible and Small, with no change anticipated at receptors 17-18, 20 and 24; the reduction of pollutant concentrations is likely due to the reduction in emission exposure at the human health receptors where the proposed route options are further from receptors and the change in traffic movements (i.e. traffic using alternative routes). The highest order of potential magnitude of impact is Medium (and represents a worsening), predicted at receptor 21 for option ST2B, which is a result of the emissions at the underpass.

15.4.19 Overall, the proposed route options are anticipated to result in changes with potential impacts of Imperceptible to Small magnitude for annual mean PM_{10} concentrations. Predicted concentrations are below the AQOs.

15.4.20 Table 15.14 provides a summary of the annual mean $PM_{2.5}$ impact magnitudes for each proposed route option. A full breakdown of receptor results is provided in Annex E of *Appendix A15.1: Air Quality Annexes*.

Table 15.14: Annual Mean $PM_{2.5}$ Air Quality Human Health Impact Summary

Receptor	Option ST2A	Option ST2B	Option ST2C	Option ST2D
1	Imperceptible	Imperceptible	Imperceptible	Imperceptible
2	Small	Small	Small	Small
3	Imperceptible	Imperceptible	Imperceptible	Imperceptible
4	Imperceptible	Imperceptible	Small	Imperceptible
5	No change	No change	No change	No change
6	Imperceptible	Small	Imperceptible	Imperceptible
7	No change	No change	No change	Imperceptible
8	Small	No change	Imperceptible	No change
9	Large	No change	No change	No change
10	No change	Small	Small	Small
11	Small	Small	No change	Small
12	No change	No change	Small	No change
13	No change	No change	Small	No change
14	Imperceptible	Imperceptible	Imperceptible	Imperceptible
15	No change	No change	Imperceptible	No change
16	Small	Small	Small	Small
17	No change	No change	No change	No change
18	No change	No change	No change	No change
19	Small	No change	Imperceptible	No change
20	No change	No change	No change	No change
21	Imperceptible	Large	No change	Small
22	No change	No change	Imperceptible	No change
23	Small	Small	Small	Small
24	Imperceptible	Imperceptible	No change	No change
25	No change	No change	No change	No change
Overall	**Imperceptible**	**Imperceptible**	**Imperceptible**	**Imperceptible**

Green shading = beneficial; Orange shading = adverse

15.4.21 All proposed route options are anticipated to increase $PM_{2.5}$ concentrations at human health receptors 1-4 and 14 with potential impact magnitude ranging from Imperceptible to Small; the worsening of annual mean $PM_{2.5}$ concentrations are likely due to the proposed route options main alignments, which brings higher volumes of traffic and therefore emissions closer to human health receptors. All proposed route options are anticipated to reduce $PM_{2.5}$ concentrations at human health receptors 16 and 23, with potential magnitude of Small; the reduction of pollutant concentrations is likely due to the reduction in emission exposure at the human health receptors where the proposed route options are further from receptors and the likely change in traffic movements (i.e. traffic using alternative routes).

15.4.22 Option ST2A is anticipated to see a potential impact of Large magnitude at receptor 9 as the result of the turbines in the tunnel. Although the potential magnitude of $PM_{2.5}$ increase is assessed as Large, the total concentrations are below the AQO.

15.4.23 Option ST2B is anticipated to experience a potential impact of Large magnitude at receptor 21, which is the result of emissions at the underpass. The total $PM_{2.5}$ concentration is below the AQO.

15.4.24 All proposed route options are predicted to have no change at human health receptors 5, 17-18, 20, and 25.

15.4.25 Overall, the proposed route options are anticipated to give rise to a potential impact of Imperceptible magnitude in annual mean $PM_{2.5}$ concentrations, and there are no predicted exceedances of the $PM_{2.5}$ AQO for any of the proposed route options.

15.4.26 As indicated in Tables 15.12, 15.13 and 15.14, the magnitude of change in annual mean pollutant concentration, ranges from Imperceptible to Large magnitude across receptors in Options ST2A, ST2B, and ST2C, and from Imperceptible to Medium magnitude for Option ST2D.

Designated Habitat Receptors

15.4.27 Predicted nitrogen deposition rates at worst case transect locations, for each of the proposed route options, are reported in Tables 15.15, 15.16, 15.17 and 15.18. The full assessment results for nutrient nitrogen deposition are presented in *Annex F of Appendix A15.1: Air Quality Annexes.*

Table 15.15: Summary of Nitrogen deposition rates (kg N/ha/yr) at worst case locations on transects – Option ST2A

Transect ID	Receptor name	Distance to nearest ARN link (m)	OS Receptor Location Co-ordinates		APIS data - Average Total N Deposition (kgN/ha/yr)	Total Deposition Rate (KgN/ha/yr)		Critical Load (min) (kgN/ha/yr)	DS-DM PC/CL (min) (%)	Is there potential for significant effects (Yes (Y) /No (N))	Approximate Distance (m) at which the potential for impacts are removed
			X(m)	Y(m)		DM	DS				
A1	ECO_A1_01	7.7	300441	743791	13.3	18.3	20.1	10	17.7	Y	118
G	ECO_G_01	19.8	305887	739464	14.1	17.5	18.5	10	9.8	Y	110
H	ECO_H_01	8.2	305882	739425	14.1	18.7	20.1	10	13.7	Y	108
I	ECO_I_10[A]	94.8	305083	739821	14.0	14.4	14.5	10	0.8	N	0
J1	ECO_J1_02	22.3	304605	740224	13.3	18.7	17.5	5	-23.5	N	0
J2	ECO_J2_02[C]	26.0	304490	740277	13.3	14.6	16.6	5	38.5	Y	206
K	ECO_K_01	16.3	303595	741389	13.3	16.8	17.9	10	11.3	Y	106
L	ECO_L_01	32.8	303986	740725	13.3	13.7	13.7	10	0.7	N	0
M	ECO_M_01	61.5	302895	741752	13.3	14.3	14.8	5	8.9	Y	142
N	ECO_N_01	8.3	302505	742039	13.3	16.5	19.0	10	25.2	Y	118
O	ECO_O_01	8.0	300539	742482	13.3	17.0	19.9	5	58.0	Y	178
P	ECO_P_01	17.0	300231	743135	13.3	13.8	15.1	5	25.4	Y	157
Q	ECO_Q_00	11.4	300331	743700	13.3	14.2	14.4	5	4.3	Y	81
R	ECO_R_01	10.6	300439	743667	13.3	16.9	19.3	5	48.4	Y	181
U	ECO_U_21	25.5	305794	739412	14.1	17.1	17.9	5	15.4	Y	126
V	ECO_V_03[C]	28.1	304962	739718	14.1	16.9	17.8	5	18.0	Y	138

Transect ID	Receptor name	Distance to nearest ARN link (m)	OS Receptor Location Co-ordinates		APIS data - Average Total N Deposition (kgN/ha/yr)	Total Deposition Rate (KgN/ha/yr)		Critical Load (min) (kgN/ha/yr)	DS-DM PC/CL (min) (%)	Is there potential for significant effects (Yes (Y) /No (N))	Approximate Distance (m) at which the potential for impacts are removed
			X(m)	Y(m)		DM	DS				
W	ECO_W_00	29.9	304119	740884	13.3	15.4	16.7	10	12.3	Y	190
X	ECO_X_01	8.2	301053	742338	13.3	16.9	20.0	5	62.7	Y	188
Y	ECO_Y_01	20.1	300390	742767	13.3	18.6	17.1	10	-14.3	N	0
Z	ECO_Z_01	8.4	300405	743499	13.3	16.5	17.8	10	12.6	Y	108

Note A: Option ST2A crosses transect points I_01 to I_09.
Note B: Option ST2A crosses transect point J2_01.
Note C: Option ST2A crosses transect points V_01 to V_02.

Table 15.16: Summary of Nitrogen deposition rates (kg N/ha/yr) at worst case locations – Option ST2B

Transect ID	Receptor name	Distance to nearest ARN link (m)	OS Receptor Location Co-ordinates		APIS data - Average Total N Deposition (kgN/ha/yr)	Total Deposition Rate (KgN/ha/yr)		Critical Load (min) (kgN/ha/yr)	DS-DM PC/CL (min) (%)	Is there potential for significant effects (Yes (Y) /No (N))	Approximate Distance (m) at which the potential for impacts are removed
			X(m)	Y(m)		DM	DS				
A1	ECO_A1_01	7.7	300441	743791	13.3	18.3	20.1	10	17.6	Y	118
G	ECO_G_01	19.8	305887	739464	14.1	17.5	18.8	10	12.8	Y	120
H	ECO_H_01	8.2	305882	739425	14.1	18.7	20.5	10	17.8	Y	118
I	ECO_I_01	26.7	305017	739760	14.0	16.8	18.4	10	16.2	Y	137
J1	ECO_J1_02	22.3	304605	740224	13.3	18.7	18.4	5	-5.1	N	0
J2	ECO_J2_01	16.0	304497	740283	13.3	15.0	18.5	5	71.3	Y	206
K	ECO_K_01	13.6	303595	741389	13.3	16.8	19.2	10	24.5	Y	134

Transect ID	Receptor name	Distance to nearest ARN link (m)	OS Receptor Location Co-ordinates		APIS data - Average Total N Deposition (kgN/ha/yr)	Total Deposition Rate (KgN/ha/yr)		Critical Load (min) (kgN/ha/yr)	DS-DM PC/CL (min) (%)	Is there potential for significant effects (Yes (Y) /No (N))	Approximate Distance (m) at which the potential for impacts are removed
			X(m)	Y(m)		DM	DS				
L	ECO_L_01	32.8	303986	740725	13.3	13.7	13.8	10	1.1	Y	43
M	ECO_M_01	61.4	302895	741752	13.3	14.3	15.1	5	14.4	Y	181
N	ECO_N_01	8.4	302505	742039	13.3	16.5	18.7	10	22.1	Y	108
O	ECO_O_01	8.1	300539	742482	13.3	17.0	19.9	5	57.9	Y	178
P	ECO_P_01	16.9	300231	743135	13.3	13.8	15.1	5	25.3	Y	157
Q	ECO_Q_00	11.4	300331	743700	13.3	14.2	14.4	5	4.2	Y	81
R	ECO_R_01	10.6	300439	743667	13.3	16.9	19.3	5	48.2	Y	181
U	ECO_U_21	25.5	305794	739412	14.1	17.1	18.6	5	31.1	Y	176
V	ECO_V_01	8.1	304977	739732	14.1	18.6	21.4	5	54.6	Y	188
W	ECO_W_00	7.4	304119	740884	13.3	15.4	17.1	10	16.5	Y	107
X	ECO_X_01	20.3	301053	742338	13.3	16.9	20.0	5	62.0	Y	200
Y	ECO_Y_01	20.1	300390	742767	13.3	18.6	17.1	10	-14.5	N	0
Z	ECO_Z_01	8.6	300405	743499	13.3	16.5	17.8	10	12.6	Y	109

Table 15.17: Summary of Nitrogen deposition rates (kg N/ha/yr) at worst case locations – Option ST2C

Transect ID	Receptor name	Distance to nearest ARN link (m)	OS Receptor Location Co-ordinates		APIS data - Average Total N Deposition (kgN/ha/yr)	Total Deposition Rate (KgN/ha/yr)		Critical Load (min) (kgN/ha/yr)	DS-DM PC/CL (min) (%)	Is there potential for significant effects (Yes (Y) /No (N))	Approximate Distance (m) at which the potential for impacts are removed
			X(m)	Y(m)		DM	DS				
A1	ECO_A1_01	7.7	300514	743484	13.3	18.3	20.1	10	17.4	Y	118
G	ECO_G_01	19.8	305031	739774	14.1	17.5	18.9	10	13.7	Y	120
H	ECO_H_01	8.2	305907	739623	14.1	18.7	20.6	10	19.5	Y	118
I	ECO_I_01	26.7	304747	740334	14.0	16.8	18.4	10	16.2	Y	137
J1	ECO_J1_02	22.3	304339	740161	13.3	18.7	18.4	5	-5.3	N	0
J2	ECO_J2_01	16.0	304450	740246	13.3	15.0	18.5	5	71.1	Y	206
K	ECO_K_01	13.5	303537	741284	13.3	16.8	19.1	10	23.3	Y	134
L	ECO_L_01	33.0	303887	740709	13.3	13.7	13.8	10	1.2	Y	43
M	ECO_M_01	55.9	302448	741934	13.3	14.3	14.9	5	11.5	Y	156
N	ECO_N_06	20.4	300444	742353	13.3	14.3	14.6	10	2.9	Y	50
O	ECO_O_01	8.1	300051	743138	13.3	17.0	19.9	5	56.9	Y	178
P	ECO_P_01	16.9	300231	743135	13.3	13.8	15.1	5	25.3	Y	157
Q	ECO_Q_00	11.3	300596	743638	13.3	14.2	14.4	5	4.3	Y	81
R	ECO_R_01	10.6	305857	739267	13.3	16.9	19.3	5	47.9	Y	181
U	ECO_U_21	25.6	300524	743482	14.1	17.1	18.6	5	31.2	Y	176
V	ECO_V_01	8.1	304243	740968	14.1	18.6	21.4	5	54.6	Y	188

Transect ID	Receptor name	Distance to nearest ARN link (m)	OS Receptor Location Co-ordinates		APIS data - Average Total N Deposition (kgN/ha/yr)	Total Deposition Rate (KgN/ha/yr)		Critical Load (min) (kgN/ha/yr)	DS-DM PC/CL (min) (%)	Is there potential for significant effects (Yes (Y) /No (N))	Approximate Distance (m) at which the potential for impacts are removed
			X(m)	Y(m)		DM	DS				
W	ECO_W_00	7.5	300186	743662	13.3	15.4	17.2	10	17.5	Y	108
X	ECO_X_01	8.4	304882	739643	13.3	16.9	19.8	5	58.2	Y	178
Y	ECO_Y_01	20.0	301060	742458	13.3	18.6	17.1	10	-14.5	N	0
Z	ECO_Z_01	8.4	300493	742804	13.3	16.5	17.8	10	12.5	Y	108

Note A: Option ST2C crosses transect receptor points Eco_N_01 to Eco_N_05.

Table 15.18: Summary of Nitrogen deposition rates (kg N/ha/yr) at worst case locations – Option ST2D

Transect ID	Receptor name	Distance to nearest ARN link (m)	OS Receptor Location Co-ordinates		APIS data - Average Total N Deposition (kgN/ha/yr)	Total Deposition Rate (KgN/ha/yr)		Critical Load (min) (kgN/ha/yr)	DS-DM PC/CL (min) (%)	Is there potential for significant effects (Yes (Y) /No (N))	Approximate Distance (m) at which the potential for impacts are removed
			X(m)	Y(m)		DM	DS				
A1	ECO_A1_01	7.7	300441	743791	13.3	18.3	20.1	10	17.6	Y	118
G	ECO_G_01	19.8	305887	739464	14.1	17.5	18.8	10	12.8	Y	120
H	ECO_H_01	8.2	305882	739425	14.1	18.7	20.5	10	17.8	Y	118
I	ECO_I_01	26.7	305017	739760	14.0	16.8	18.4	10	16.2	Y	137
J1	ECO_J1_02	22.3	304605	740224	13.3	18.7	18.4	5	-5.1	N	0
J2	ECO_J2_01	16.0	304497	740283	13.3	15.0	18.5	5	71.3	Y	206
K	ECO_K_01	13.6	303595	741389	13.3	16.8	19.2	10	24.5	Y	134
L	ECO_L_01	32.8	303986	740725	13.3	13.7	13.8	10	1.1	Y	43

Transect ID	Receptor name	Distance to nearest ARN link (m)	OS Receptor Location Co-ordinates		APIS data - Average Total N Deposition (kgN/ha/yr)	Total Deposition Rate (KgN/ha/yr)		Critical Load (min) (kgN/ha/yr)	DS-DM PC/CL (min) (%)	Is there potential for significant effects (Yes (Y) /No (N))	Approximate Distance (m) at which the potential for impacts are removed
			X(m)	Y(m)		DM	DS				
M	ECO_M_01	61.4	302895	741752	13.3	14.3	15.0	5	13.5	Y	181
N	ECO_N_01	8.4	302505	742039	13.3	16.5	18.7	10	22.1	Y	108
O	ECO_O_01	8.1	300539	742482	13.3	17.0	19.9	5	57.9	Y	178
P	ECO_P_01	16.9	300231	743135	13.3	13.8	15.1	5	25.3	Y	157
Q	ECO_Q_00	11.4	300331	743700	13.3	14.2	14.4	5	4.2	Y	81
R	ECO_R_01	10.6	300439	743667	13.3	16.9	19.3	5	48.2	Y	181
U	ECO_U_21	25.5	305794	739412	14.1	17.1	18.6	5	31.1	Y	176
V	ECO_V_01	8.1	304977	739732	14.1	18.6	21.4	5	54.6	Y	188
W	ECO_W_00	7.4	304119	740884	13.3	15.4	17.1	10	16.5	Y	107
X	ECO_X_01	20.3	301053	742338	13.3	16.9	20.0	5	62.0	Y	200
Y	ECO_Y_01	20.1	300390	742767	13.3	18.6	17.1	10	-14.5	N	0
Z	ECO_Z_01	8.6	300405	743499	13.3	16.5	17.8	10	12.6	Y	109

15.4.28 All proposed route options demonstrate the potential for significant nitrogen deposition effects to occur at a number of designated habitats along the length of the proposed route options. The number of designated habitat locations where the respective effect, is 'not significant' are as follows:

- Option ST2A – four 'not significant' transects;
- Option ST2B – two 'not significant' transects;
- Option ST2C – two 'not significant' transects;
- Option ST2D – two 'not significant' transects.

15.4.29 A comparison of individual transects between different proposed route options highlights the changes in extent of potential impacts, potential for significant effects and the total deposition rate. This is likely due to a combination of road alignment changes (i.e. distance from the road source to transect point), a change in traffic movements (i.e. traffic using alternative routes) and speeds and also the additional contributions (at receptors closest to the tunnel entrances/exits) as a result of the tunnel (ST2A) and underpass (ST2B) options.

15.4.30 At DMRB Stage 2, detailed survey information was not available to establish the conditions at each of the designated habitat sites to allow a full determination of significance. This assessment has identified areas of potential significance at worst case locations, which would be considered in more detail at DMRB Stage 3 for the Preferred Route Option. It is noted that existing deposition rates at all transects assessed, are above the respective Critical Loads for their respective habitat.

Overall Significance of Effects on Local Air Quality

15.4.31 There are no affected links within the EU Compliance Risk Road Network. Therefore, all links within the study area assessed are compliant with the Directive 2008/50/EC.

15.4.32 Overall, the proposed route options are predicted to result in potential pollutant concentration changes at human health receptors ranging from Imperceptible to Large magnitude. The pollutant concentrations at all assessed receptors are below the objective thresholds set to protect human health. It is therefore considered that none of the proposed route options result in the potential for significant air quality effects on human health receptors. This is summarised in Table 15.19.

15.4.33 All proposed route options are predicted to give rise to increases in nutrient nitrogen deposition rates above 1% of the Critical Load at a majority of transect locations where road alignments would be moved closer and traffic movements have changed (i.e. traffic using alternative routes). There is the potential for significant effects on designated sites for all proposed route options (refer to Table 15.19).

Table 15.19: Overall Evaluation of the Significance of Effect on Local Air Quality

No.	Key Criteria Question	Option ST2A	Option ST2B	Option ST2C	Option ST2D
1	Is there a risk that environmental standards will be breached?	No	No	No	No
2	Will there be a large change in environmental conditions?	Yes	Yes	Yes	No
3	Will the effect continue for a long time?	Yes	Yes	Yes	No
4	Will many people be affected?	No	No	No	No
5	Is there a risk that designated sites, areas, or features will be affected?	Yes	Yes	Yes	Yes
6	Will it be difficult to avoid, reduce, repair or compensate for the effect?	Yes	Yes	Yes	No
7	On balance is the overall effect significant?	No	No	No	No

Note: In Table 15.19, a "yes" in the "is there potential for impacts" represents the results for the proposed route options that show a Large potential change in the magnitude of concentrations (i.e. greater than a 1% increase) for any pollutant at human health receptors. Conversely a "no" represent no potential for impacts (i.e. less than a 1% increase). As this potentially Large magnitude of change in concentrations occurs in the operation phase then the effect is assumed to continue over a long period of time.

15.5 Potential Mitigation

Construction

15.5.1 In terms of mitigation for potential construction impacts, a total of 381 receptors were identified within a distance of 200m of the proposed route options, where construction activities could temporarily affect local air quality, primarily in terms of fugitive emissions of dust/particulate matter. Mitigation would be developed during the DMRB Stage 3 assessment and is likely to relate to application of best practice to reduce generation of dust at source. Examples include wetting of unsurfaced access roads and monitoring of deposition at any receptors potentially significantly affected. Implementation of these measures during construction would ensure that the potential construction impacts of the proposed route options are not significant.

Operation

15.5.2 Detailed mitigation is not included in the DMRB Stage 2 assessment, however, based on the results of this assessment, it is highly unlikely that any operational mitigation would be required for the human health aspect of the assessment for any of the proposed route options.

15.5.3 Regarding potential mitigation for designated sites, please refer to Chapter 11 (Biodiversity).

15.6 Summary of Route Options Assessment

15.6.1 This section provides a summary of the DMRB Stage 2 assessment of potential impacts for the proposed route options, taking into account the anticipated potential mitigation as described in Section 15.5 (Potential Mitigation).

15.6.2 For the comparison of proposed route options, two aspects are considered; whether the potential for any residual effects would be considered significant in the context of the EIA Regulations, and whether any of the potential impacts and effects identified differ sufficiently between proposed route options that they can be considered a differentiator and need to be considered as part of the overall identification of the Preferred Route Option which, as explained in Volume 1, Part 3 – Environmental Assessment (Chapter 7: Overview of Environmental Assessment), takes into account environmental, engineering, economic and traffic considerations.

15.6.3 Table 15.20 provides a summary of the significant effects on Air Quality.

Table 15.20: Summary of Assessment – Air Quality

Chapter/Subcategory			Residual Effects				Comments
			Option ST2A	Option ST2B	Option ST2C	Option ST2D	
Air Quality	Construction	Dust and Local Air Quality	Not Significant				Whilst there are differences between the proposed route options, these differences are not considered to be a differentiator.
	Operation	Human Health Receptors	Not Significant				
		Designated Habitats	Potentially Significant				

Compliance Against Plans and Policies

15.6.4 DMRB LA 104 (Highways et al., 2020) states that environmental assessment, reporting and monitoring shall meet the requirements of the national planning policy for each relevant Overseeing Organisation.

15.6.5 *Appendix A21.1 (Assessment of Policy Compliance)* provides a review of national and local policy documents which are of relevance to this assessment undertaken and reported in this chapter in accordance with DMRB guidance.

15.6.6 National Planning Policy objectives (and accompanying best practice guidance) of relevance to this assessment are provided in National Planning Framework 3 (NPF3) (Scottish Government, 2014a), Scottish Planning Policy (SPP) (Scottish Government, 2014b; Revised 2020) themes *Sustainability, A Low Carbon Place* and *A Natural, Resilient Place*, as well as PAN 51 (Planning, Environmental Protection and Regulation) (Scottish Executive, 2006), the Environment Strategy for Scotland: Vision and Outcomes (2020) (Scottish Government, 2020), Climate Change Plan: third report on proposals and policies 2018-2032 (Scottish Government, 2018b), and Cleaner Air for Scotland: The Road to a Healthier Future (Scottish Government, 2015). In addition, local policies of relevance include Perth and Kinross Local Development Plan 2 (PKC LDP2) (PKC 2019) Policy 57 (Air Quality).

15.6.7 A full policy compliance assessment can be found in Table 7 of *Appendix A21.1 (Assessment of Policy Compliance)*. It is assessed that although construction related effects are assessed to be not significant, potential significant effects upon designated sites for all proposed route options may result in policy non-compliance. As explained, detailed survey information was not available at DMRB Stage 2, therefore, a full policy compliance assessment will be undertaken at DMRB Stage 3 assessment when a full determination of significance can be assigned.

Community Objectives

15.6.8 The community objectives (refer to Volume 1, Part 3 – Environmental Assessment (Chapter 7: Overview of Environmental Assessment, Table 7.2)) have been considered throughout DMRB Stage 2. *Appendix A7.1: Mapping of Community Objectives Against DMRB Stage 2 Route Options* sets out which DMRB Stage 2 environmental topics are relevant to each of the objectives.

15.6.9 *Appendix A7.1: Mapping of Community Objectives Against DMRB Stage 2 Route Options* confirms that community objective 1 is relevant to the assessment of Air Quality. Professional judgement has been used to consider how the proposed route options contribute to the community objectives for the operation phase, as summarised in Table 15.21.

15.6.10 The contribution of the operation phase of each of the proposed route options to the relevant community objectives was categorised according to the following key.

Contributes to all/most of the community objective	
Contributes to part of the community objective	
Contributes to little/none of the community objective	

Table 15.21: Contribution to Community Objectives During Operation for this Environmental Topic

Relevant Community Objective		Option ST2A	Option ST2B	Option ST2C	Option ST2D
1	Reduce current levels of noise and pollution in the villages of Dunkeld, Birnam and Inver to protect human health and well-being of residents and visitors and to enable them to peacefully enjoy their properties and amenity spaces.				

15.6.11 Generally, there is an increase in concentrations of pollutants at most receptors for all proposed route options. However, no AQOs are breached and the pollutant concentrations at all assessed human health receptors are below the objective values set to protect human health. All proposed route options are considered to contribute to little/none of the community objectives.

Comparative Assessment

15.6.12 The DMRB Stage 2 assessment of air quality has identified that, although there are some differences between proposed route options in terms of number and types of effects, these effects are not considered significant as the pollutant concentrations at all assessed human health receptors are below the objective values set to protect human health. A summary of the assessment is provided in Table 15.20.

15.6.13 Regarding designated habitats, the differences between the proposed route options are not sufficient to be considered a differentiator. A summary of the assessment is provided in Table 15.20.

15.7 Scope of Stage 3 Assessment

15.7.1 It is proposed that the Stage 3 assessment for Air Quality would be undertaken in accordance with the DMRB LA 105 (Highways England et al., 2019).

15.7.2 DMRB Stage 3 would include assessment of operational impacts on local air quality and also the potential for dust nuisance during the construction phase.

15.7.3 Given the low impact in terms of air quality for Option ST2C and Option ST2D as identified through the simple assessment reported in this chapter, a detailed level of assessment at DMRB Stage 3 may not be necessary if these options are taken forward to DMRB Stage 3, provided that neither the route nor the traffic data change notably. The level of assessment for the DMRB Stage 3 assessment required should be reviewed and confirmed in line with other A9 dualling projects currently underway.

15.7.4 If Option ST2A or Option ST2B are taken forward to DMRB Stage 3, a detailed assessment would be undertaken using dispersion modelling software.

15.7.5 Construction impacts would be assessed qualitatively, based on likely construction activities and distance to sensitive receptors, and would identify best practice mitigation to be outlined at DMRB Stage 3. Construction assessment is undertaken in accordance with guidance contained within the IAQM 'Guidance on the Assessment of Dust from Demolition and Construction' (IAQM, 2014).

15.8 References

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16. Noise and Vibration

16.1 Introduction

16.1.1 This chapter presents the Design Manual for Roads and Bridges (DMRB) Stage 2 assessment of the proposed route options in relation to potential noise and vibration impacts on humans at locations such as residential properties, schools and places of worship.

16.1.2 Within the study area, the noise environment is influenced predominantly by traffic on the existing A9. Road traffic noise is generated by the interaction of tyres on the road surface, from engines and exhausts, and from the aerodynamic noise caused by vehicles moving through the air. For different speeds, gradients, acceleration, traffic composition (i.e. the ratio of heavy-duty vehicles to lighter vehicles) and road surface types, each of these noise sources contributes a different amount to the total.

16.1.3 The assessment is supported by two appendices:

- Appendix A16.1: Detailed Baseline Noise Survey Results and Notes; and
- Appendix A16.2: Noise Assessment Summary Tables.

16.1.4 The assessment is also supported by figures:

- Figure 16.1: DMRB Stage 2 Noise Assessment Study Area and Sample Receptors;
- Figures 16.2a-d: Potential Beneficial and Adverse Significant Effects at all Noise Sensitive Receptors during Operation, without Mitigation.

Legislative and Policy Background

16.1.5 Please refer to Volume 1, Part 3 – Environmental Assessment (Chapter 21: Policies and Plans and *Appendix A21.1 Assessment of Policy Compliance*) for full details of the legislation and policy relevant to noise and vibration. A summary of the legislation, policy and guidance relevant to the assessment of noise and vibration is set out in the following paragraphs. As described in Chapter 7 (Overview of Environmental Assessment) relevant pre-Brexit EU legislation now transposed into UK law is also referenced.

16.1.6 The approach to this assessment is based on the guidance provided by:

- DMRB LA 111 Noise and Vibration (Highways England et al, 2020a). This includes guidance on the assessment methods for noise and vibration from new highways. The DMRB is adopted by Transport Scotland for new trunk road schemes. Revision 2, issued in May 2020, has been used in this assessment and is hereafter referred to as 'DMRB LA 111'.
- Calculation of Road Traffic Noise (CRTN) (Department of Transport Welsh Office, 1988), which is the authoritative method for predicting road traffic noise levels in the UK.
- Control of Pollution Act 1974 (HMSO, 1974).
- Control of Noise (Codes of Practice for Construction and Open Sites) (Scotland) Order 2002 (The Scottish Government, 2002).
- Planning Advice Note (PAN) 1/2011– Planning and Noise (The Scottish Government, 2011a).
- Technical Advice Note (TAN) – Assessment of Noise (The Scottish Government, 2011b).
- BS 5228:2009+A1:2014 'Code of practice for noise and vibration control on construction and open sites' Part 1 - Noise and Part 2 – Vibration (BSI, 2014b).

16.1.7 In addition, The Environmental Noise (Scotland) Regulations 2006 were taken into account. The regulations implement the Environmental Noise Directive (END) 2002/49/EC of the European Parliament and of the Council of 25 June 2002.

16.1.8 The Noise Insulation (Scotland) Regulations 1975 define the conditions under which dwellings may be eligible for noise insulation to control internal noise levels. While the properties that would meet the operational noise mitigation criteria are identified in Section 16.5 (Potential Mitigation), the number of properties likely to be eligible for statutory insulation would be indicated as part of a DMRB Stage 3 level assessment, and this is therefore not considered further in this assessment.

16.1.9 At DMRB Stage 3, a noise mitigation strategy would be developed, and noise mitigation measures would be proposed, where practicable, in terms of acceptable standards in terms of traffic, safety, environmental and economic issues. Potential mitigation, subject to further assessment at DMRB Stage 3, is detailed in Section 16.5 (Potential Mitigation).

16.1.10 A review of relevant national, regional and local planning policies and guidance relevant to noise and vibration are identified in the following paragraphs.

National Planning Policy and Guidance

16.1.11 The Scottish Governments publication PAN 1/2011 – Planning and Noise and the accompanying Technical Advice Note (TAN) – Assessment of Noise contains specific guidance on the assessment of potential noise impacts from new road schemes.

Regional and Local Planning Policy and Guidance

16.1.12 Regional and local planning policy and guidance relevant to the assessment of Noise and Vibration are summarised in Volume 1, Part 3 – Environmental Assessment (Chapter 21 – Policies and Plans and *Appendix A21.1: Assessment of Policy Compliance*).

16.2 Approach and Methods

Consultation

16.2.1 A summary of the consultation is reported in Volume 1, Part 3 – Environmental Assessment (Chapter 7 – Overview of Environmental Assessment, Section 7.6 (Consultation)).

Identification of Noise Sensitive Receptors

16.2.2 DMRB LA 111 defines noise sensitive receptors (NSRs) as '*receptors which are potentially sensitive to noise*' and provides examples which include:

- dwellings;
- hospitals;
- healthcare facilities;
- education facilities;
- community facilities;
- European Noise Directive (END) quiet areas or potential END quiet areas;
- international and national or statutorily designated sites;
- public rights of way; and
- cultural heritage assets.

16.2.3 Although DMRB LA 111 does not assign a level of sensitivity to noise sensitive receptors, the examples presented in DMRB LA 111 are broadly in line with the examples of receptors with a high sensitivity provided in Table 2.1 in TAN – Assessment of Noise (Scottish Government 2011b), reproduced in Table 16.1.

Table 16.1: Level of Sensitivity Associated with Various Examples of NSRs (Reproduced from Table 2.1 of TAN)

Sensitivity	Description	Example of Receptor Usage
High	Receptors where people or operations are particularly susceptible to noise.	▪ Residential, including private gardens where appropriate. ▪ Quiet outdoor areas used for recreation. ▪ Conference facilities. ▪ Theatres/auditoria/studios. ▪ Schools during the daytime. ▪ Hospitals/residential care homes. ▪ Places of worship.
Medium	Receptors moderately sensitive to noise, where it may cause some distraction or disturbance.	▪ Offices. ▪ Bars/cafes/restaurants where external noise may be intrusive. ▪ Sports grounds when spectator noise is not a normal part of the event and where quiet conditions are necessary (e.g. tennis, golf, bowls).
Low	Receptors where distraction or disturbance from noise is minimal.	▪ Buildings not occupied during working hours. ▪ Factories and working environments with existing high noise levels. ▪ Sports grounds when spectator noise is a normal part of the event. ▪ Night clubs.

16.2.4 Identification of NSRs is primarily based on Ordnance Survey (OS) MasterMap Topography Layer® and AddressBase® Plus data.

16.2.5 Identification of END quiet areas and noise management areas is based on the noise maps published by the Scottish Government and the Transportation Noise Action Plan (TNAP) published by Transport Scotland (Transport Scotland, 2018). No END quiet areas or potential quiet areas have been identified within the noise assessment study areas. In addition, no END Noise Management Areas (NMAs) or Candidate Noise Management Areas (CNMAs) have been identified within the noise assessment study areas.

Overview of the Assessment Method

16.2.6 There is no specific guidance published by Transport Scotland or Highways England (formerly The Highways Agency) detailing a noise assessment methodology to be used when comparing the proposed route options at DMRB Stage 2. The operational noise assessment therefore broadly followed the guidance in DMRB LA 111 for the consideration of short-term and long-term changes in airborne noise levels at sensitive receptors. It should be noted that the noise assessment undertaken for this project is more detailed at this stage than for other A9 dualling projects (for example Project 03, Project 04 and Project 05 in the Southern Section). This is to reflect the feedback from the A9 Co-Creative Process that noted the importance of noise impacts on the local community.

16.2.7 The DMRB LA 111 methodology is suitable for the assessment of the Preferred Route Option at DMRB Stage 3; however, it considers a range of potential noise impacts, which are not all required for the purposes of a route option appraisal. Therefore, the methodology was simplified and adapted as follows:

- no assessment of operational noise impacts beyond 600m of new road links or roads physically changed by the proposed route options has been undertaken;

- the noise assessment focusses on building façades which face the scheme or the nearest affected route, rather than considering noise changes on all façades of the buildings; and
- a set of initial significance criteria has been developed based on the guidance in DMRB LA 111 for the purposes of the route option appraisal.

16.2.8 The methodology for assessing the operational noise impacts considers noise level changes at dwellings and other sensitive receptors within the study area. This is undertaken by comparing their baseline façade noise levels for the Do-Minimum (DM) scenario (i.e. without the proposed route options) against the noise levels predicted for the Do-Something (DS) scenario (i.e. with the proposed route options). This comparison is undertaken for the first year of full operation (2026) and the future assessment year (2041) for each proposed route option.

16.2.9 The methodology for assessing the construction noise and vibration impacts is based on identifying any construction operations which could have a significant effect for each proposed route option.

Baseline Conditions

16.2.10 As part of the assessment a baseline noise survey was undertaken at the eight sample receptors to support the validation of the noise model outputs and inform understanding of the existing noise climate within the vicinity of the proposed route options. The results of the baseline noise survey are summarised in Section 16.3 (Baseline Conditions) and presented in more detail in *Appendix A16.1: Detailed Baseline Noise Survey Results and Notes.*

Assessment of Construction Noise Impacts and Effects

16.2.11 For the construction noise assessment, DMRB LA 111 refers to the use of BS 5228:2009+A1:2014 – Code of Practice for noise and vibration control on construction and open sites – Part 1: Noise (BSI, 2014a) , hereafter referred to as BS 5228-1. It should be noted that previous versions of BS 5228 (Part 1:1997 and Part 4:1992) are still officially approved under Section 71 of the Control of Pollution Act 1974 via The Control of Noise (Codes of Practice for Construction and Open Sites) (Scotland) Order 2002.

16.2.12 BS 5228-1 states that: '*Good relations with people living and working in the vicinity of site operations are of paramount importance*'. It suggests that the early establishment and maintenance of these relations throughout the contract would go some way to allaying people's concerns.

16.2.13 The standard also advises that it is not possible to provide detailed guidance for determining whether or not noise from a site would constitute a problem in a particular situation as a number of factors would affect the acceptability of the site noise and vibration. These factors are:

- site location;
- existing ambient noise and vibration levels;
- duration of site operations;
- hours of work;
- attitude to site operator; and
- noise and vibration characteristics.

16.2.14 The level of noise experienced by inhabitants in the vicinity would vary according to the following factors:

- sound power outputs of processes and plant;
- periods of operation of processes and plant;

- distance from source(s) to receiver(s);
- presence of screening by barriers;
- reflection of sound associated with topographical features;
- phasing/programming of demolition works;
- soft ground attenuation; and
- meteorological factors.

16.2.15 BS 5228-1 provides methods for the calculation of noise from construction activities, including information regarding noise levels from a range of construction equipment. A more detailed assessment of constructability has been undertaken for this project than is typical at DMRB Stage 2 and this is detailed in Volume 1, Part 2 - Engineering Assessment. This information has been used to consider potential indicative construction noise levels during construction, given the possible impact on the local community.

16.2.16 DMRB LA 111 states that the Lowest Observed Adverse Effect Level (LOAEL) (the level above which adverse effects on health and quality of life can be detected) and Significant Observed Adverse Effect Level (SOAEL) (the level above which significant adverse effects on health and quality of life can occur) shall be established and reported within the environmental assessment for all noise sensitive receptors within the construction activity study area. The LOAEL shall be established using baseline noise levels whilst the SOAEL shall be set as the threshold level, determined following BS 5228-1 Section E3.2 and Table E.1. Table E.1 of BS 5228-1 is reproduced in Table 16.2.

Table 16.2: Example Threshold of Potential Significant Effect at Dwellings (Reproduced from Table E.1 of BS 5228-1)

Assessment Category and Threshold Value Period	Threshold Value ($L_{Aeq,T}$ dB)		
	Category A[A]	Category B[B]	Category C[C]
Night-time (23:00 – 07:00)	45	50	55
Evenings and weekends[D]	55	60	65
Daytime (07:00 – 19:00) and Saturdays (07:00 – 13:00)	65	70	75
Note 1 A potential significant effect is indicated if the $L_{Aeq,T}$ noise level arising from the sites exceeds the threshold level for the category appropriate to the ambient noise level. **Note 2** If the ambient noise level exceeds the Category C threshold values given in the table (i.e. the ambient noise level is higher than the above values), then a potential significant effect is indicated if the total $L_{Aeq,T}$ noise level for the period increases by more than 3dB due to site noise. **Note 3** Applied to residential receptors only.*			
[A] Category A: threshold values to use when ambient noise levels (rounded to the nearest 5dB) are less than these values. [B] Category B: threshold values to use when ambient noise levels (rounded to the nearest 5dB) are the same as category A values. [C] Category C: threshold values to use when ambient noise levels (rounded to the nearest 5dB) are higher than category A values. [D] 19:00 – 23:00 weekdays, 13:00 – 23:00 Saturdays and 07:00 – 23:00 Sundays			

* Although BS 5228-1 notes that this method for determining threshold values is for residential receptors only, this method has been applied for all NSRs within the construction assessment study area, as required by DMRB LA 111.

16.2.17 DMRB LA 111 provides guidance on determining the magnitude of impact for construction noise. The classification of construction noise magnitude of impacts is detailed in Table 16.3, reproduced from Table 3.16 of DMRB LA 111. As discussed above, the LOAEL is the baseline ambient noise level at the NSR and the SOAEL is the corresponding threshold level determined in accordance with BS 5228-1.

Table 16.3: Construction Noise Magnitude of Impact (Reproduced from Table 3.16 of DMRB LA 111)

Magnitude of Impact	Construction Noise Level
Major	Above or equal to SOAEL +5dB
Moderate	Above or equal to SOAEL and below SOAEL +5dB
Minor	Above or equal to LOAEL and below SOAEL
Negligible	Below LOAEL

16.2.18 DMRB LA 111 states that the LOAEL and SOAEL are derived from ambient noise levels. However, at this stage, it is deemed unnecessary to assign a baseline noise level to each receptor and a corresponding LOAEL and SOAEL. The LOAEL has not been defined as it is not required for the determination of significant effects. The SOAEL will be derived based on Category A from Table E.1 of BS 5228-1 (see Table 16.2), which will give an appropriate overview of noise effects of potential construction activities, whilst also providing a worst-case assessment.

16.2.19 In accordance with paragraph 3.19 of DMRB LA 111, construction noise shall constitute a significant effect where it is determined that a major or moderate magnitude of impact will occur for a duration exceeding:

- 10 or more days or nights in any 15 consecutive days or nights; or
- a total number of days or nights exceeding 40 in any 6 consecutive months.

16.2.20 Once a Contractor is appointed, a construction noise and vibration assessment would usually be required based on the working methods, timing and phasing of the works and the quantity and type of plant likely to be used by the Contractor. The provisions of Sections 60 and 61 of the Control of Pollution Act 1974 offer some protection to those living near the construction. Section 60 enables a local authority to serve a notice specifying its noise control requirements covering:

- plant or machinery that is or is not be used;
- hours of working; and
- levels of noise or vibration that can be emitted.

16.2.21 Section 61 relates to prior consent and is for situations where a Contractor or developer takes the initiative and approaches the local authority before work starts to obtain approval for the methods to be used and any noise and vibration control techniques that may be required.

Assessment of Construction Vibration Impacts

16.2.22 With regards to construction vibration impacts, DMRB LA 111 refers to the use of BS 5228:2009+A1:2014 – Code of Practice for noise and vibration control on construction and open sites – Part 2: Vibration (BSI, 2014b), hereafter referred to as BS 5228-2. Within BS 5228-2 there is guidance in relation to the effects of construction vibration upon the surroundings of the works. Vibration, even of a very low magnitude, can be perceptible to people, although it should be noted that some individuals are more sensitive to vibration than others. Vibration nuisance is frequently associated with the assumption that, if vibration can be felt, then damage is inevitable. However, considerably greater levels of vibration are required to cause damage to buildings and structures.

16.2.23 Guidance on human response and guide values for the cosmetic damage of buildings from construction works is provided in BS 5228-2, and reproduced in Tables 16.4 and 16.5. Both tables refer to the Peak Particle Velocity (PPV), which is defined as the maximum instantaneous positive or negative peak of the vibration signal. It is specified in millimetres per second (mm/s). It should be noted that the PPV refers to the movement within the ground of molecular particles and not surface movement.

Table 16.4: Guidance on Effects of Vibration Levels in mm/s PPV – Human Response (Source: BS 5228-2)

Vibration Level[A), B), C)]	Effect
0.14 mm/s	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration
0.3 mm/s	Vibration might be just perceptible in residential environments
1.0 mm/s	It is likely that vibration of this level in residential environments will cause complaint, but can be tolerated if prior warning and explanation has been given to residents
10 mm/s	Vibration is likely to be intolerable for any more than a very brief exposure to this level in most building environments

A) The magnitudes of the values presented apply to a measurement position that is representative of the point of entry into the recipient.

B) A transfer function (which relates an external level to an internal level) needs to be applied if only external measurements are available.

C) Single or infrequent occurrences of these levels do not necessarily correspond to the stated effect in every case. The values are provided to give an initial indication of potential effects, and where these values are routinely measured or expected then an assessment in accordance with BS 6472-1 or -2, and/or other available guidance, might be appropriate to determine whether the time varying exposure is likely to give rise to any degree of adverse comment.

Table 16.5: Transient Vibration Guide Values for Cosmetic Damage (Source: BS 5228-2)

Type of Building	Peak Component Particle Velocity in Frequency Range of Predominant Pulse	
	4Hz to 15Hz	15Hz and above
Reinforced or framed structures. Industrial and heavy commercial buildings	50mm/s at 4Hz and above	50 mm/s at 4Hz and above
Unreinforced or light framed structures. Residential or light commercial buildings	15mm/s at 4Hz increasing to 20mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40Hz and above

NOTE 1 Values referred to are at the base of the building

NOTE 2 For row 2, at frequencies below 4 Hz, a maximum displacement of 0.6 mm (zero to peak) is not to be exceeded.

16.2.24 Minor damage is possible at vibration magnitudes which are greater than twice those given in Table 16.5, with major damage at values greater than four times the values in the table. BS 7385-2 also notes that the probability of cosmetic damage tends towards zero at 12.5 mm/s peak component particle velocity.

16.2.25 DMRB LA 111 states that the LOAEL and SOAEL for construction vibration shall be set as detailed in Table 16.6, reproduced from Table 3.31 of DMRB LA 111.

Table 16.6: Construction Vibration LOAELs and SOAELs (Reproduced from Table 3.31 of DMRB LA 111)

Time Period	LOAEL	SOAEL
All time periods	0.3mm/s PPV	1.0mm/s PPV

16.2.26 DMRB LA 111 provides guidance on determining the magnitude of impact for construction vibration. The classification of construction vibration magnitude of impacts is detailed in Table 15.7, reproduced from Table 3.33 of DMRB LA 111.

Table 15.7: Construction Vibration Magnitude of Impact (Reproduced from Table 3.33 of DMRB LA 111)

Magnitude of Impact	Construction Vibration Level
Major	Above or equal to 10mm/s PPV
Moderate	Above or equal to SOAEL and below 10mm/s PPV
Minor	Above or equal to LOAEL and below SOAEL
Negligible	Below LOAEL

16.2.27 In accordance with paragraph 3.19 of DMRB LA 111, construction vibration shall constitute a significant effect where it is determined that a major or moderate magnitude of impact will occur for a duration exceeding:

- 10 or more days or nights in any 15 consecutive days or nights; or
- a total number of days or nights exceeding 40 in any 6 consecutive months.

16.2.28 Although not specified in DMRB LA 111, construction vibration has also been considered a significant effect if there is deemed to be a risk of cosmetic or structural damage at a building due to construction vibration.

16.2.29 There are currently no British Standards that provide methods to predict levels of vibration from all construction activities, other than those contained within BS 5228-2, which relates primarily to percussive or vibratory piling, compaction and tunnelling.

16.2.30 BS 5228-2 provides recommendations for basic methods of vibration control relating to construction and open sites where work activities/operations generate significant vibration levels, including industry specific guidance. With consideration to the nature and size of the proposed route options as well as the likely construction processes, it is considered that any required blasting, piling or heavy earthmoving processes are the key construction activities that have the potential to give rise to significant vibration effects.

16.2.31 In cognisance of the above, an indicative quantitative assessment of vibration impacts was undertaken to identify construction operations associated with the proposed route options which could have a potentially significant effect, based on the guidance above and using professional judgement.

Road Traffic Noise Calculation Method

16.2.32 Noise levels have been calculated using the CadnaA® noise modelling package, which implements the methodology contained in CRTN. All calculated noise levels are in terms of the façade incident $L_{A10,18hr}$ noise indicator which is used to quantify road traffic noise levels in the UK.

16.2.33 CRTN predictions are based on typical weekday traffic flows during the 18-hour period from 06:00 to 00:00 (18-hour AAWT flows) and take into account the following variables:

- percentage of Heavy Goods Vehicles (HGVs);
- traffic speeds;
- road gradient;
- local topography;
- the nature of the ground surface between the road and the receptor;
- shielding effects of any intervening structures, including allowances for limited angles of view from the road and any reflection effects from relevant surfaces; and

- the type and texture depth of the road surface.

16.2.34 It is assumed that the road surfaces on the mainline of the proposed route options are Low Noise Road Surfaces (LNRS), and an appropriate surface correction in accordance with DMRB LA 111 has been applied within the calculations. All other road surfaces, including the existing A9, are impervious and bituminous e.g. Hot Rolled Asphalt. In the future assessment year only, it is assumed that the A9 surfacing beyond the proposed route options would also be LNRS.

16.2.35 Traffic data for the noise models have been generated by traffic models using an S-Paramics Microsimulation. These traffic models represent the actions and inter-actions of individual vehicles as they travel through the road network. Detail on the traffic models is provided in Volume 1, Part 4 -Traffic and Economic Assessment of this DMRB Stage 2 Scheme Assessment Report.

16.2.36 In line with the range of validity for the correction for speed within CRTN, a minimum traffic speed of 20km/h and maximum traffic speed of 130km/h are used in the noise models where the traffic model predictions provide speeds less than or greater than these.

16.2.37 Within the traffic modelling data provided for each of the proposed route options, there are some road links on which a traffic flow of less than 1,000 vehicles (18-hour AAWT flow) are predicted. CRTN Paragraph 30 provides guidance on the reliability of low traffic flows and states that calculations of noise level for traffic flows below 1,000 vehicles (18-hour AAWT) are unreliable. As such, a number of assumptions have been made for this assessment:

- Where, for a particular road link, the traffic flows for all years assessed are all less than 1,000 vehicles (18-hour AAWT flow), the flow for each scenario is assumed to be zero vehicles, i.e. the road is not included in the assessment.
- Where, for a particular road link, the traffic flows vary around the threshold level of 1,000 vehicles (e.g. DM 2026 = 900 and DS 2026 = 1,100), the traffic flows which are less than 1,000 vehicles (18-hour AAWT flow) are also included in the assessment. This approach is taken to avoid exaggerating any increase or reduction in noise which would occur if one of the traffic flows was assumed to be zero.

16.2.38 It is therefore considered that while noise levels calculated for roads with flows of less than 1,000 vehicles per day may be subject to increased error, the approach adopted is appropriate in the situation.

16.2.39 Physical features such as building outlines, existing road alignments and widths, and ground surface characteristics were imported into the CadnaA® noise models from the Ordnance Survey (OS) MasterMap Topography Layer digital mapping. Terrain heights are derived from filtered (bare earth) LiDAR data which have been used to generate contour lines at 2m vertical intervals.

16.2.40 Noise levels at the façades of receptors were calculated at first floor level (4m above ground level), except for bungalows, applicable churches, schools, doctor surgeries, other single storey receptors and outdoor receptors which are all calculated at 1.5m above ground level. Noise levels at buildings were predicted at a distance of 1m from the most exposed façade and include a 2.5dB façade correction. Noise levels for sensitive receptors positioned in open spaces are free-field values (i.e. there are no acoustically reflective surfaces within 3.5m, except the ground).

Road Traffic Noise Study Area

16.2.41 The study area for the calculation of road traffic noise level change was defined based on DMRB LA 111 and was defined as the area within 600m of new road links or road links physically changed or bypassed by the proposed route options.

16.2.42 A single study area for this assessment was determined by creating a 600m buffer around each of the proposed route options and merging them together. The noise sensitive receptors within the study area are therefore consistent across the proposed route options being assessed.

16.2.43 DMRB LA 111 requires the calculation of Basic Noise Levels (BNL) for noise sensitive receptors that are not covered by calculations of noise level change and are within 50m of road links where noise levels are predicted to change by at least 1dB(A) in the short-term or 3dB(A) in the long-term. At this stage of the assessment process, BNLs have not been calculated for each of the proposed route options and therefore the likely noise impacts on the wider road network have not been considered. BNL changes would be considered during the noise impact assessment of the Preferred Route Option at DMRB Stage 3. Therefore, for this assessment the study area is equivalent to the area within 600m of each of the proposed route options, which is shown on Figure 16.1.

16.2.44 Noise assessments may need to take into account Transportation Noise Action Plans prepared by Scottish Ministers in accordance with The Environmental Noise (Scotland) Regulations 2006 (ENR).

16.2.45 In respect of noise from major roads, the ENR set out the following objectives:

- to determine the noise exposure of the population by mapping;
- to make the information on environmental noise available to the public; and
- to establish [Transportation Noise] Action Plans based on the mapping results to prevent and reduce environmental noise where necessary and to preserve environmental noise quality where it is good.

16.2.46 The geographical scope for Transportation Noise Action Plans is determined by the location of roads with more than three million vehicle passages a year. The A9 was included in the noise mapping exercise and subsequent Transportation Noise Action Plan. However, there are no areas designated 'Noise Management Areas' or 'Quiet Areas' near to the study area, and therefore there are no relevant Transportation Noise Action Plans to be considered by this assessment.

Sensitive Receptors within Study Area

16.2.47 Sensitive receptors were identified using OS AddressBase® Plus data which provides use classifications for properties. However, a number of buildings within this dataset are as yet unclassified, and therefore aerial imagery has been reviewed to determine whether any are residential dwellings; a precautionary approach was undertaken so where the use of the building was not clear, it was included as a dwelling.

16.2.48 A total of 782 residential dwellings and 45 other noise sensitive receptors were identified within the study area. The majority of the dwellings are located within the settlements of Birnam, Dunkeld, Inver and Little Dunkeld. The remainder of the road traffic noise study area is sparsely populated, particularly to the north end of the study area, with isolated and small clusters of dwellings (generally situated close to the existing A9).

16.2.49 The other receptors include five hotels, one guest house, three caravan parks, the Royal School of Dunkeld, The Hermitage, five parks, three play areas and four churches.

16.2.50 The heights of buildings within the noise model have been derived from online imagery. To ensure consistency with the noise assessments undertaken at DMRB Stage 2 for other A9 projects, two storey high buildings are assumed to be 5.7m, one storey buildings such as bungalows are assumed to be 3.2m tall and smaller buildings such as sheds and garages are assumed to be 2.5m tall. For buildings with more than two storeys, building heights are assumed to increase 2.5m per storey.

16.2.51 Road traffic noise levels have been assessed at all of the sensitive receptors identified within the study area. However, a sub-set of eight sample receptors have been selected for reporting purposes (refer to Table 16.8 (listed in a south to north direction) and Figure 16.1). These sample receptors are considered to have noise environments representative of those at other nearby receptors. These locations have been selected to provide examples of the predicted changes in road traffic noise near to and along the length of the proposed route options.

Table 16.8: Sample Receptors

Reference No.	Receptor Name and Location	Grid Reference	
		Easting	Northing
R2.01	West Ringwood Cottage, Birnam	304506	740230
R2.02	Hollybank, Perth Road, Birnam	303795	741350
R2.03	Oakbank, Birnam	303116	741523
R2.04	The Old Bakehouse, 12 Birnam Terrace, Birnam	303185	741710
R2.05	9 Telford Gardens, Birnam	302847	741924
R2.06	Braeknowe, Birnam	302636	741921
R2.07	Corbiere, Little Dunkeld	302604	742162
R2.08	Craigview, Inver	301668	742250

Assessment of Operational Noise Impacts

16.2.52 Paragraph 3.54 of DMRB LA 111 provides guidance on the magnitude of impacts for traffic noise. The classification of noise impact magnitude is as detailed in Tables 16.9 and 16.10.

Table 16.9: Classification of Magnitude of Short-Term Noise Impacts

Short-term Magnitude of Impact	Short-term Noise Change ($L_{A10,18hr}$ or L_{night})
Major	Greater than or equal to 5.0
Moderate	3.0 to 4.9
Minor	1.0 to 2.9
Negligible	Less than 1.0

Table 16.10: Classification of Magnitude of Long-Term Noise Impacts

Long-term Magnitude of Impact	Long-term Noise Change ($L_{A10,18hr}$ or L_{night})
Major	Greater than or equal to 10.0
Moderate	5.0 to 9.9
Minor	3.0 to 4.9
Negligible	Less than 3.0

16.2.53 DMRB LA 111 states that the initial assessment of the likely significant effect on noise sensitive buildings shall be determined using the significance criteria in Table 16.11, which is reproduced from Table 3.58 of DMRB LA 111.

Table 16.11: Initial Assessment of Operational Noise Significance (Reproduced from Table 3.58 of DMRB LA 111)

Significance	Short-term Magnitude
Significant	Major
Significant	Moderate
Not significant	Minor
Not significant	Negligible

16.2.54 Following the initial determination of significance based on the short-term magnitude of impact, DMRB LA 111 states that where the magnitude of impact in the short-term is negligible at noise sensitive buildings, it shall be concluded that the noise impact will not cause changes to behaviours or response to noise and, as such, will not give rise to a likely significant effect.

16.2.55 However, for noise sensitive receptors where the magnitude of impact in the short-term is minor, moderate or major at noise sensitive receptors then the final significance of effect shall be determined by considering other factors, which include:

- noise level change relative to minor/moderate impact boundary;
- differing magnitude of impact in the long-term and/or future year, compared to the short-term;
- absolute noise level with reference to LOAEL and SOAEL;
- location of noise sensitive parts of a receptor, e.g. location of sensitive room windows or garden areas;
- acoustic context e.g. does the proposed scheme change the acoustic character of the area; and,
- likely perception of change by residents, e.g. changes to landscape or receptor setting.

16.2.56 At this early stage (DMRB Stage 2) of the project, consideration of the above factors at every noise sensitive receptor with a minor, moderate or major magnitude of impact in the short-term would not reflect a proportionate assessment. Therefore, in order to establish the significance of the predicted noise changes for this assessment, the following assessment criteria have been adopted for the purposes of the route option appraisal at DMRB Stage 2. These criteria can be applied in an automated way based on noise model outputs and are based on the significance assessment guidance provided in DMRB LA 111.

16.2.57 For the purposes of this DMRB Stage 2 assessment it is considered that there is the potential for a significant noise effect to occur where there is:

- A 1dB change in the short-term or 3dB change in the long-term (i.e. 'minor' impact from DMRB LA 111) where the resulting noise level exceeds the SOAEL. In the long-term, the noise level must also change by at least 1dB when comparing the DM 2041 and DS 2041 scenarios to ensure the change is as a result of the proposed scheme opposed to a change that would happen even if the proposed scheme did not go ahead; and
- A 3dB change in the short-term or 5dB change in the long-term (i.e. 'moderate' impact from DMRB LA 111) where the resulting noise level is between the LOAEL and SOAEL.

16.2.58 Where noise levels are below the LOAEL, significant effects are not expected.

Community Objectives

16.2.59 At an early stage in the A9 Co-Creative Process, the Birnam to Ballinluig A9 Community Group generated community objectives. The seven objectives are presented in Volume 1, Part 3 – Environmental Assessment (Chapter 7 - Overview of Environmental Assessment) and cover a wide range of topics but focus predominantly on environmental issues.

16.2.60 The community objectives have been taken into consideration throughout the DMRB Stage 2 process and a mapping exercise was conducted to indicate how, in the operational phase, the proposed route options could contribute to the relevant objectives. Details of how each environmental topic contributes towards achieving the community objectives are presented in *Appendix A7.1: Mapping of Community Objectives Against DMRB Stage 2 Route Options* and a summary for this chapter is presented in Section 16.6.

Limitations to Assessment

16.2.61 It should be noted that this DMRB Stage 2 assessment was prepared prior to and during the global COVID-19 coronavirus pandemic. Throughout 2020 and in early 2021, there have been significant and extensive restrictions in place in Scotland on the movement of people and the activities that are permitted. Due to the duration and extent of such restrictions, some of the baseline and survey updates have not been achievable.

16.2.62 In order to facilitate the accurate prediction of construction noise and vibration levels, it is necessary to know working methods, timing and phasing of the works and the quantity and type of plant likely to be used. The full construction sequencing and details are not likely to be fully developed and known until a specimen design is available and the Contractor has been appointed. Accordingly, an indicative quantitative assessment of likely construction phases that would take place has been undertaken using professional judgement and previous experience of assessing similar road projects.

16.2.63 Road traffic noise modelling studies are dependent on computer-modelling of future traffic conditions. The noise model itself is dependent on input data taken from modelled traffic data and on a number of other assumptions. All computer modelled information is subject to an inherent degree of uncertainty and depends on a number of assumptions.

16.2.64 At any location, noise levels vary from time to time throughout the day, and from day to day. The operational noise level presented for an NRS should be considered as indicative and are intended to represent the typical road traffic noise level across a whole year, rather than the road traffic noise level on a specific day or at a specific time. Caution should therefore be exercised in comparing measured noise levels with predicted noise levels.

16.2.65 It is considered that all data inputs for this DMRB Stage 2 assessment are of an adequate level to support the level of assessment as defined in DMRB LA 111.

16.3 Baseline Conditions

16.3.1 Road traffic is identified as the primary source of noise in the study area. The full results of the noise monitoring, including site notes and photographs are provided in *Appendix A16.1: Detailed Baseline Noise Survey Results and Notes.*

16.3.2 To assist in the understanding of the existing noise levels and explain the noise climate in areas near the proposed route options, modelled predicted noise levels were compared with the measured noise levels at the eight sample receptors. The predicted noise levels of the existing road network were calculated using the assumptions discussed in Section 16.2 (Approach and Methods) and base model traffic data for 2015.

16.3.3 It should be noted that there is rarely complete agreement between predicted and measured noise levels. The predicted noise levels use traffic flow data for an 18-hour period averaged over a year, while the measured levels are dependent on the traffic at the time of the measurement. The measured noise levels are also affected by noise sources other than road traffic noise, while the predicted noise levels are based on road traffic noise only. Due to the precautionary approach to the noise assessment, local acoustic barriers such as walls on a property or field boundaries are not included in the 3D noise models. In addition, the CRTN prediction method assumes light downwind propagation from every modelled road to every prediction point in the model. This is unlikely to occur in reality. These factors can result in relatively wide variations between measured noise levels and predicted baseline noise levels. Table 16.12 provides a comparison between the predicted and measured noise levels, with the difference calculated by subtracting the measured noise level from the predicted noise level. The average measured $L_{A10,18hr}$ noise levels include only data measured on weekdays to allow comparison with the calculated $L_{A10,18hr}$, which is based on weekday only traffic data.

Table 16.12: Comparison of Calculated and Measured Baseline Road Traffic Noise Levels

Reference No.	Receptor	Predicted Noise Level ($L_{A10,18hr}$ dB)	Measured Noise Level ($L_{A10,18hr}$ dB)	Noise Level Difference (dB)
R2.01	West Ringwood Cottage	58.6	57.2	+1.4
R2.02	Hollybank, Perth Road	57.4	54.9	+2.5
R2.03	Oakbank	58.3	56.0	+2.3
R2.04	The Old Bakehouse, 12 Birnam Terrace	58.0	53.9	+4.1
R2.05	9 Telford Gardens	62.7	56.7	+6.0
R2.06	Braeknowe	58.4	56.2	+2.2
R2.07	Corbiere	61.8	58.8	+3.0
R2.08	Craigview	64.1	64.4	-0.3

16.3.4 The results in Table 16.12 show that at two of the locations (R2.01 and R2.08) there is a difference of less than 2dB between the modelled predicted noise levels and the measured noise levels. At the six remaining locations the discrepancies between the measured and modelled levels are considered further:

- At sample receptors R2.02, R2.03, R2.06 and R2.07, the difference between the predicted and measured noise levels is between +2.2dB and +3.0dB. Given the differences expected when comparing predicted noise levels based on annual average traffic data with measured levels in conditions specific to when the monitoring was undertaken, as discussed in paragraph 16.3.3, the differences between the measured and predicted noise levels are considered reasonable.
- At sample receptor R2.04, the difference between the predicted and measured noise levels is +4.1dB. There is a close boarded timber fence running along the southern boundary of properties at The Old Bakehouse, between R2.04 and the existing A9 (as seen in the top left corner of Photograph 4 in *Appendix A16.1: Detailed Baseline Noise Survey Results and Notes*). The fence would provide additional screening of the road from the sample receptor and explain the differences between the predicted and measured noise levels.
- At sample receptor R2.05, the difference between the predicted and measured noise levels is +6.0dB. There is a close boarded timber fence running along the south boundary of properties on Telford Gardens, between R2.05 and the A9 (as seen in Photograph 5 in *Appendix A16.1: Detailed Baseline Noise Survey Results and Notes*). The fence would provide additional screening of the road from the sample receptor and explain the differences between the predicted and measured noise levels.

16.3.5 Based on the above, the modelled results were determined to be suitable for this assessment and, as such, no amendments were made to the noise models.

16.4 Potential Impacts and Effects

Introduction

16.4.1 Potential noise and vibration impacts and effects for all proposed route options during construction and operation are described in this section. While embedded mitigation is included in the noise models for the proposed route options, further specific mitigation, such as that detailed in Section 16.5 (Potential Mitigation), is not included. Further consideration of the need to utilise these mitigation measures would be undertaken at DMRB Stage 3.

16.4.2 Potential operational impacts and effects are reported for each of the sample receptor locations (R2.01 to R2.08). Reference is also made to noise changes for all identified sensitive receptors, with the results for these presented in *Appendix A16.2: Noise Assessment Summary Tables*.

Embedded Mitigation

16.4.3 The proposed route options require the construction of cuttings and embankments (collectively referred to as 'earthworks'). Earthworks for the proposed route options have been included within the noise models. Although no earthworks were included within the design specifically to provide mitigation to NSR, the proposed earthworks in some locations, such as where there are embankments alongside the A9 in the proposed route options, would offer a greater degree of noise attenuation than if they were not included.

16.4.4 In addition, as part of the proposed route options, all mainline and slip roads would be surfaced with a low noise road surfacing material. According to DMRB LA 111, this can reduce noise levels by approximately 3.5dB $L_{A10,18hr}$, in comparison with conventional Hot Rolled Asphalt (HRA) surfacing of 1.5mm texture depth, which can reduce noise levels by approximately 0.5 dB $L_{A10,18hr}$, although these corrections are only valid for sections with traffic speeds of at least 75km/h.

Construction Noise Impacts

Construction Working Hours and Schedule/Phasing

16.4.5 Based on discussions with PKC (Environmental Health), it is assumed that construction works for all proposed route options would be undertaken between 07:00 and 19:00 Monday to Friday, and between 08:00 and 13:00 on Saturdays, with no working on a Sunday or Bank Holidays. However, specific arrangements would be made by the Contractor, in liaison with PKC (Environmental Health) and other stakeholders, including the local community.

16.4.6 The estimated durations of the construction phases for the proposed route options are:

- Option ST2A – 4.5 to 5 years;
- Option ST2B – 4 to 4.5 years;
- Option ST2C – 2.5 to 3 years; and
- Option ST2D – 2.5 to 3 years.

16.4.7 The construction of the 1.5km cut and cover tunnel for Option ST2A is anticipated to be split into four construction sections, with three of these sections likely being constructed simultaneously to aid the construction programme. The timescale for the piling operations for the cut and cover tunnel construction is expected to be approximately 12-18 months. The duration of the piling operations for the 150m underpass in Option ST2B is expected to be of a similar duration. Further construction details are included in Volume 1, Part 2 - Engineering Assessment.

Construction Activities

16.4.8 Based on the proposed constructability assessment for the proposed route options, detailed in Volume 1, Part 2 - Engineering Assessment of this DMRB Stage 2 report, and previous experience of large construction projects, the following construction practices (refer to Table 16.13) are anticipated to have noise impacts and resultant effects:

- earthworks movement and formation;
- breaking existing road surface;
- installation of bored piles;
- installation of sheet piles at Inchewan Burn;
- rolling and compaction of pavement surface and foundation materials;
- construction of structures;
- formation of pavement areas; and
- construction of retaining walls.

16.4.9 It should be noted that these are an indicative representation of likely construction phases that would take place. The full construction sequencing and details are not likely to be fully developed and known until a specimen design is available and Contractor has been appointed.

16.4.10 Table 16.13 presents details for typical plant which could reasonably be expected to be used during construction, with corresponding source noise levels taken from tables in BS 5228-1, or from noise levels measured during previous assessments.

Table 16.13: Indicative Plant and Equipment to be used during Construction

Phase	Activity	Plant Description	No.	% On-Time	Shift Duration (hrs)	Duration of Activity (hrs)	% Activity Time	Total L_w dB
Earthworks	Earthworks	Tracked excavator 35t	2	30%	12	10	83%	111.0
	Dumping Load	Articulated dump truck 40t	3	30%	12	10	83%	111.8
	Earthworks	Dozer (41t)	2	25%	12	10	83%	111.0
	Material Distribution	Lorry (4-axle wagon)	2	30%	12	10	83%	111.0
Breaking Road Surface	Breaking Concrete	Breaker on backhoe (7.4t)	1	10%	12	10	83%	120.0
	Material Distribution	Wheeled excavator (14t)	2	30%	12	10	83%	90.0
	Material Distribution	Lorry (4-axle wagon)	2	30%	12	10	83%	111.0

Phase	Activity	Plant Description	No.	% On-Time	Shift Duration (hrs)	Duration of Activity (hrs)	% Activity Time	Total L_w dB
Bored Piling	Earthworks	Tracked excavator 35t	1	30%	12	10	83%	108.0
	Rotary bored piling	Rotary bored piling rig (110t)	2	25%	12	10	83%	114.0
	Lifting	Wheeled mobile crane (35t)	1	30%	12	10	83%	98.0
	Pumping Concrete	Concrete pump + truck (6t)	1	30%	12	10	83%	103.0
	Material Distribution	Lorry (4-axle wagon)	1	30%	12	10	83%	108.0
Sheet Piling (at Inchewan Burn)	Earthworks	Tracked excavator 35t	1	30%	12	10	83%	108.0
	Sheet steel piling	Vibratory piling rig (52t)	1	30%	12	10	83%	116.0
	Material Distribution	Lorry (4-axle wagon)	1	30%	12	10	83%	108.0
	Material Distribution	Telescopic handler (10t)	1	30%	12	10	83%	99.0
Rolling and Compaction	Rolling & Compaction	Roller (rolling fill) (18t)	2	30%	12	10	83%	110.0
	Earthworks	Dozer (41t)	1	25%	12	10	83%	108.0
	Material Distribution	Lorry (4-axle wagon)	2	25%	12	10	83%	111.0
Structures	Earthworks	Tracked excavator 35t	1	30%	12	10	83%	108.0
	Material Distribution	Lorry (4-axle wagon)	1	20%	12	10	83%	108.0
	Rolling & Compaction	Vibratory roller 8.9t	1	25%	12	10	83%	103.0
	Pumping Concrete	Concrete mixer truck	1	30%	12	10	83%	107.0
	Concrete Other	Poker vibrator	1	15%	12	10	83%	106.0
	Concrete Other	Vibratory tamper	1	10%	12	10	83%	91.0
	Breaking Road	Compressor	2	20%	12	10	83%	96.0
	Lifting	Mobile telescopic crane (100t)	1	30%	12	10	83%	99.0
Paving	Paving	Asphalt paver (+ lorry) 18t	1	40%	12	10	83%	105.0
	Rolling & Compaction	Road roller 22t	2	25%	12	10	83%	111.0
	Material Distribution	Lorry (4-axle wagon)	2	25%	12	10	83%	111.0
	Power for Breaker	JCB AirMaster	1	25%	12	10	83%	101.0
	Breaking up Concrete	Hand held pneumatic breaker	1	15%	12	10	83%	111.0
Retaining Walls	Lifting	Telescopic handler (4t)	1	30%	12	10	83%	107.0
	Clearing Site	Wheeled backhoe loader (8t)	1	30%	12	10	83%	96.0

Phase	Activity	Plant Description	No.	% On-Time	Shift Duration (hrs)	Duration of Activity (hrs)	% Activity Time	Total L_w dB
	Lifting	Mobile telescopic crane (100t)	1	30%	12	10	83%	99.0
	Earthworks	Tracked excavator 35t	1	30%	12	10	83%	108.0
	Material Distribution	Lorry (4-axle wagon)	1	20%	12	10	83%	108.0
	Rolling & Compaction	Vibratory roller 8.9t	1	25%	12	10	83%	103.0
	Pumping Concrete	Concrete mixer truck	1	30%	12	10	83%	107.0
	Concrete Other	Poker vibrator	1	15%	12	10	83%	106.0

16.4.11 During construction there would usually be multiple equipment in operation at the same time. To provide an indication of construction noise levels during construction, Table 16.13 provides indicative noise emissions for typical plant using typical combinations for each phase. Table 16.14 shows the changes to noise levels over distance from the construction works. Noise levels exceeding the assumed construction SOAEL for this assessment (65 dB $L_{Aeq,T}$) are highlighted with a red background. This level of SOAEL may be exceeded at a few individual NSR across each option. However, to enable a broad comparison of the proposed route options, the most likely and worst case SOAEL of 65 dB $L_{Aeq,T}$ has been assumed.

16.4.12 To provide a comparison of the construction noise impacts between the proposed route options, Table 16.14 also includes a comparison of the number of NSR properties within the distance bands. The number of NSR properties which are predicted to experience construction noise levels exceeding the assumed construction SOAEL for this assessment (65dB $L_{Aeq,T}$) are also highlighted with a red background. These would be properties that may experience a significant construction noise effect, in line with the guidance in BS 5228-1, in the event exceedance duration criteria were also met (refer to paragraph 16.2.19).

16.4.13 It is considered that intervening topography and buildings are likely to provide a degree of acoustic screening for many NSR properties, although at this time screening has not been taken into account in the calculations presented in Table 16.14.

Table 16.14: Calculated Construction Noise Levels for Indicative Construction Phases and NSR Property Counts

Phase	Distance from Construction Works (m)	Indicative Construction Noise Level (dB $L_{Aeq,T}$)	No. of NSR Properties in Distance Band			
			ST2A	ST2B	ST2C	ST2D
Earthworks	0 - 10	86.0 (at 10m)	14	10	30	5
	10 - 20	80.0 (at 20m)	35	27	32	26
	20 - 50	70.6 (at 50m)	67	71	53	73
	50 - 100	63.0 (at 100m)	134	133	128	134
	100 - 200	55.5 (at 200m)	107	111	123	114
	200 - 300	51.1 (at 300m)	75	80	73	73
Total No. of NSR Properties within 300m			432	432	439	425
	0 - 10	85.6 (at 10m)	6	6	5	3

Phase	Distance from Construction Works (m)	Indicative Construction Noise Level (dB $L_{Aeq,T}$)	No. of NSR Properties in Distance Band			
			ST2A	ST2B	ST2C	ST2D
Breaking Road Surface	10 - 20	79.6 (at 20m)	17	13	14	14
	20 - 50	70.1 (at 50m)	67	67	59	65
	50 - 100	62.6 (at 100m)	123	126	119	124
	100 - 200	55.1 (at 200m)	139	140	155	146
	200 - 300	50.7 (at 300m)	61	61	63	61
Total No. of NSR Properties within 300m			413	413	415	413
Bored Piling	0 - 10	84.6 (at 10m)	0	0	N/A	N/A
	10 - 20	78.5 (at 20m)	4	2	N/A	N/A
	20 - 50	69.1 (at 50m)	42	9	N/A	N/A
	50 - 100	61.6 (at 100m)	96	50	N/A	N/A
	100 - 200	54.0 (at 200m)	111	71	N/A	N/A
	200 - 300	49.6 (at 300m)	63	59	N/A	N/A
Total No. of NSR Properties within 300m			316	181	N/A	N/A
Sheet Piling (at Inchewan Burn)	0 - 10	86.2 (at 10m)	3	3	N/A	N/A
	10 - 20	80.2 (at 20m)	2	2	N/A	N/A
	20 - 50	70.8 (at 50m)	11	11	N/A	N/A
	50 - 100	63.2 (at 100m)	27	27	N/A	N/A
	100 - 200	55.7 (at 200m)	80	80	N/A	N/A
	200 - 300	51.3 (at 300m)	110	110	N/A	N/A
Total No. of NSR Properties within 300m			233	233	N/A	N/A
Rolling and Compaction	0 - 10	82.2 (at 10m)	14	10	30	5
	10 - 20	76.1 (at 20m)	35	27	32	26
	20 - 50	66.7 (at 50m)	67	71	53	73
	50 - 100	59.2 (at 100m)	134	133	128	134
	100 - 200	51.6 (at 200m)	107	111	123	114
	200 - 300	47.2 (at 300m)	75	80	73	73
Total No. of NSR Properties within 300m			432	432	439	425
Structures	0 - 10	82.1 (at 10m)	0	1	0	0
	10 - 20	76.0 (at 20m)	6	5	9	3
	20 - 50	66.6 (at 50m)	50	30	28	17
	50 - 100	59.1 (at 100m)	121	92	67	55
	100 - 200	51.5 (at 200m)	154	129	119	137
	200 - 300	47.1 (at 300m)	75	79	116	97
Total No. of NSR Properties within 300m			406	336	339	309
Paving	0 - 10	84.1 (at 10m)	6	6	5	4
	10 - 20	78.1 (at 20m)	14	13	20	16
	20 - 50	68.6 (at 50m)	73	73	63	70
	50 - 100	61.1 (at 100m)	129	128	118	124
	100 - 200	53.6 (at 200m)	130	132	146	138

Phase	Distance from Construction Works (m)	Indicative Construction Noise Level (dB $L_{Aeq,T}$)	No. of NSR Properties in Distance Band			
			ST2A	ST2B	ST2C	ST2D
	200 - 300	49.2 (at 300m)	64	63	69	62
Total No. of NSR Properties within 300m			416	415	421	414
Retaining Walls	0 - 10	83.0 (at 10m)	0	0	0	0
	10 - 20	77.0 (at 20m)	2	4	8	2
	20 - 50	67.6 (at 50m)	3	23	14	3
	50 - 100	60.0 (at 100m)	33	84	25	12
	100 - 200	52.5 (at 200m)	92	127	59	47
	200 - 300	48.1 (at 300m)	46	68	119	46
Total No. of NSR Properties within 300m			176	306	225	110

16.4.14 As shown in Table 16.14, NSR properties up to 50m away from construction works are predicted to experience construction noise levels in excess of 65 dB $L_{Aeq,T}$ for all activities. Between 50m and 100m there could also be an exceedance of 65 dB $L_{Aeq,T}$ in some locations for the various activities. Exceedances would occur when the works are at the nearest point to each NSR property and would decrease as the works move further away.

Comparison of Potential Construction Noise Impacts and Effects

16.4.15 The following sections of the proposed route options are considered most likely to allow differentiation between the proposed route options in terms of construction noise:

- Option ST2A – Approximately 1.5km long cut and cover tunnel adjacent to Birnam, with at-grade roundabout at Dunkeld;
- Option ST2B – Approximately 150m long underpass in vicinity of Dunkeld & Birnam Station, with at-grade roundabout at Dunkeld;
- Option ST2C – Generally at-grade widening, with grade separated junction at Dunkeld; and
- Option ST2D – Generally at-grade widening, with elongated roundabout at Dunkeld.

16.4.16 Based on an assessment of scheme constructability, this section discusses potential noise impacts that may arise during construction of the proposed route options. For all of the proposed route options, the construction activities with the greatest indicative impact on the nearest NSR properties (in terms of the highest predicted noise levels, not duration) relate to earthworks, rolling and compaction.

16.4.17 Option ST2A is likely to have the longest period of high noise levels during construction. This is due to the need for bored and sheet piling operations and other associated construction activities required to construct the 1.5km cut and cover tunnel. Where NSR properties would be affected by the piling operations and other associated construction activities these would be more likely to be potentially significant effects due to the longer period of construction.

16.4.18 Option ST2B would utilise similar construction methods to the cut and cover tunnel for the construction of the 150m long underpass in the vicinity of Dunkeld & Birnam Station. However, the piling works for Option ST2B would be required over a shorter length. The remainder of the construction works would be generally at-grade and would incorporate, as with Option ST2A, a roundabout at the Dunkeld Junction. Compared to Option ST2A, the construction of Option ST2B is predicted to result in an overall lower number of NSR properties experiencing noise levels in excess of 65dB $L_{Aeq,T}$. As with Option ST2A, where NSR properties would be affected by the piling operations and other associated construction activities these would be more likely to be potentially significant effects due to the longer period of construction.

16.4.19 Option ST2C would be generally at-grade, except for the grade separated junction at Dunkeld. No substantial piling activity is expected to be required for Option ST2C but there is likely to be increases in earthworks activities required to construct the grade separated junction at Dunkeld. Option ST2C is predicted to result in the greatest number of NSR properties that would experience noise levels in excess of 80dB $L_{Aeq,T}$ as it has the greatest number of NSR properties within 10m of earthworks and rolling and compaction activities. This is largely as a result of the grade separated junction at Dunkeld, which would place these construction activities closer to residential properties than other proposed route options. However, because no substantial piling is required, the duration of these impacts is expected to be less than for Options ST2A and ST2B and it is considered that there is less likelihood of potentially significant effects.

16.4.20 Option ST2D would be generally at-grade across its length and as a result, the scale of the construction works required are less than the other proposed route options. No substantial piling activities would be expected. This proposed route option would also be constructed in the shortest timescale, given the reduced scale of the works compared with the other proposed route options. It is considered that Option ST2D has the least likelihood of potentially significant effect.

Construction Vibration Impacts and Effects

Overview

16.4.21 Consideration of potential vibration impacts and effects as a result of the likely construction activities for each proposed route option has been undertaken. The piling required for the cut and cover tunnel in Option ST2A, the underpass in Option ST2B and the pedestrian underpass to Dunkeld & Birnam Station in Option ST2C and Option ST2D have been identified as operations which could have potentially significant construction vibration impacts.

16.4.22 The guidance provided in BS 5228-2 states that '*damage to structures or the finishes from well-controlled construction and demolition vibrations is rare*' (Section B.3.1, first paragraph). From the guidance for transient vibration values for cosmetic damage (reproduced in Table 16.5), the onset of cosmetic damage may be expected in residential or light commercial buildings in reasonable condition at 15mm/s PPV at 4Hz increasing to 20mm/s at 15 Hz for low frequency excitation. This increases to 50mm/s at 40 Hz and above. It is considered that the lower frequency levels may be more appropriate given the nature of the construction works, specifically given the possible low rotational speeds of the piling rigs.

16.4.23 For continuous vibration, BS 5228-2 suggests that the guide values may need to be reduced by 50%; however, BS 5228-2 notes that the probability of damage tends towards zero at 12.5mm/s PPV. BS 5228-2 also advises that the vibration guide levels may be reduced where a preliminary survey reveals significant defects in the building.

16.4.24 In terms of human response, the BS 5228-2 guidance on effects of vibration levels is reproduced in Table 16.4.

Vibration Impacts and effects Specific to Option ST2A and Option ST2B

16.4.25 There is potential for short-term vibration impacts for Option ST2A and Option ST2B as a result of the need to construct long lines of contiguous bored piles along both sides of the proposed 1.5km cut and cover tunnel and 150m underpass. There are no vibration calculation methodologies to assess the vibration generated by such construction methods, however BS 5228-2 includes historical measured data that can be used to infer potential impacts.

16.4.26 The most relevant historical data, for piling works within sand and gravel overlying rock (within chalk in the measured data in BS 5228-2 (Table D.6, reference number 105)) provides measured vibration levels of 2.4mm/s PPV at a plan distance of 3.5m, reducing to 1.7mm/s PPV at a plan distance of 8m.

16.4.27 The nearest building to the piling activities for Option ST2A and Option ST2B is the Category A listed building at Dunkeld & Birnam Station, which is currently unoccupied. The station building is also approximately 2.5m from the closest approach of the line of piles. Vibration levels at this distance are likely to be approximately 2.4mm/s PPV, based on the most relevant historical data. This is well below the vibration guide values for cosmetic damage in BS 5228-2, and on this basis, it is expected the piling works would not result in vibration damage to the Dunkeld & Birnam Station building

16.4.28 The nearest residential building to the piling activities for Option ST2A and Option ST2B is on Station Road and is approximately 11m to the north of the piling activities. Vibration levels at this distance are likely to be below 1.7mm/s PPV, based on the most relevant historical data. This is well below the vibration guide values for cosmetic damage in BS 5228-2, and on this basis, it is expected that piling works would not result in vibration damage at the nearest or any other residential building.

16.4.29 Although the historical measurements, when compared with the BS 5228-2 guideline values, suggest that vibration generated from bored piling should not give rise to cosmetic damage at the closest or any other buildings, further investigation would be required, and this is discussed further in Section 16.5 (Potential Mitigation).

16.4.30 In terms of human response at the nearest residential building to the piling activities, a vibration level of 1.7 mm/s PPV results in a moderate magnitude of impact and, therefore, it is considered that without mitigation, there is the potential for bored piling works to result in a significant vibration effect in terms of human response at the nearest residential buildings. With good site management and community liaison the impacts can be minimised (refer to Section 16.5 (Potential Mitigation) for more details).

16.4.31 Whilst more than one piling rig is expected to be on-site at the same time, it is unlikely that cumulative vibration impacts would occur, as it is considered unlikely that more than one piling rig would be operating in close proximity to a building at the same time.

Vibration Impacts and effects Specific to Option ST2C and Option ST2D

16.4.32 There is potential for short-term vibration impacts for Option ST2C and Option ST2D as a result of the sheet piling works associated with the construction of the proposed pedestrian underpass to Dunkeld & Birnam Station. Sheet piling in two sections with pile depths of between 8m and 10m would be required to construct the pedestrian underpass. Both percussive and vibratory sheet piling have the potential to generate greater levels of vibration than bored piling methods. BS 5228-2 includes vibration calculation methodologies for percussive and vibratory piling.

16.4.33 For the calculations undertaken, it has been assumed that pre-augering/excavation would be undertaken along the pile line for percussive piling, such that piles reach a depth of 5m before percussive force is applied. For the vibratory piling calculations, a 50% probability of the calculated level being exceeded has been assumed, as in Jacobs' experience this most commonly reflects on-site measurements.

16.4.34 The nearest building to the sheet piling activities for Option ST2C and Option ST2D is the Category A Listed Dunkeld and Birnam Station including Footbridge (Asset 26). The station building is currently unoccupied. Calculations have been undertaken to assess the potential impact upon the station building, station canopy, footbridge and platform. Percussive piling is predicted to potentially generate up to 0.8mm/s PPV at the station building (approximately 22m from the piling works), 0.9mm/s PPV at the station canopy (approximately 19m from the piling works), 2.8mm/s PPV at the base of the footbridge (approximately 7m from the piling works) and 5.5mm/s PPV at the nearest rear face of the platform (approximately 1m from the piling works).Given the calculated vibration levels, it is considered that percussive piling is unlikely to result in potential significant effects on Dunkeld & Birnam Station.

16.4.35 Assuming a 50% probability of the calculated level being exceeded, vibratory piling is predicted to potentially generate vibration levels up to 1.5mm/s PPV at the station building, 1.7mm/s PPV at the station canopy, 5.8mm/s PPV at the base of the footbridge, and 50.7mm/s PPV at the nearest rear face of the platform. Given the calculated vibration levels, it is considered that vibratory piling has the potential to lead to damage at the rear platform wall. Potential significant effects on the station building, station canopy and footbridge from vibratory piling are not expected and damage is considered unlikely. Further investigation of the mitigation to be employed would be undertaken at DMRB Stage 3, and this is discussed further in Section 16.5 (Potential Mitigation).

16.4.36 At the nearest residential building to the piling activities, which is approximately 50m away, vibration levels of 0.3mm/s PPV and 0.5mm/s PPV are predicted for percussive and vibratory piling, respectively. In terms of human response, these vibration levels result in a minor magnitude of impact. Therefore, it is considered that in terms of human response at the nearest residential buildings, potential significant vibration effects are unlikely.

Operational Impacts Specific to Option ST2A

Short-term Impacts

16.4.37 The operational assessment summary table for Option ST2A in the short-term, for the daytime period is presented in Table 1 in *Appendix A16.2: Noise Assessment Summary Tables*. Option ST2A is predicted to result in a minor adverse magnitude of impact at 66 dwellings. A negligible adverse magnitude of impact is predicted at 163 dwellings. No change is predicted at 34 dwellings. A major beneficial magnitude of impact is predicted at 206 dwellings and a moderate beneficial magnitude of impact at 64 dwellings. A minor beneficial magnitude of impact is predicted at 118 dwellings and a negligible beneficial magnitude of impact at 131 dwellings.

16.4.38 With regards to other noise sensitive receptors, in the short-term, for the daytime period, six are predicted to have a minor adverse magnitude of impact and 14 are predicted to have a negligible adverse magnitude of impact. Five are predicted to have no change. Seven are predicted to have a major beneficial magnitude of impact, one is predicted to have a moderate beneficial magnitude of impact, two are predicted to have a minor beneficial magnitude of impact and ten are predicted to have a negligible beneficial magnitude of impact.

16.4.39 The majority of the predicted moderate and major beneficial noise impacts are located in Birnam and Little Dunkeld, where Option ST2A would result in large reductions in road traffic noise near to the proposed tunnel. Other beneficial noise impacts of lower magnitude are predicted away from the tunnel due to the low noise road surfacing included as embedded mitigation. The majority of the largest predicted adverse noise impacts are located near the B867, Perth Road and the A822, where Option ST2A is predicted to result in increases in traffic flow and therefore road traffic noise on these roads. The remainder of the predicted adverse noise impacts are more directly due to the change in alignment, screening or road traffic of the A9.

16.4.40 The operational assessment summary table for Option ST2A in the short-term, for the night-time period is presented in Table 3 in *Appendix A16.2: Noise Assessment Summary Tables*. The night-time impacts are predicted to be similar to the daytime impacts summarised above.

16.4.41 The predicted change in the noise levels and the magnitude of impact at the eight sample receptors, in the short-term, for the daytime and night-time periods, are shown in Table 16.15 and Table 16.16, respectively. Receptors with beneficial impacts are highlighted with a green background and receptors with adverse impacts are highlighted with a red background. Receptors with impacts that would have the potential to result in significant effects in accordance with the criteria adopted for this assessment (refer to paragraphs 16.2.57 – 58) are highlighted in bold.

Table 16.15: Potential Short-term Daytime Impacts at Sample Receptors – Option ST2A

Reference No.	Receptor	2026 DM	2026 DS Option ST2A		
		$L_{A10,18hr}$ dB	$L_{A10,18hr}$ dB	Change	Magnitude of Impact
R2.01	West Ringwood Cottage	60.9	59.2	-1.7	Minor beneficial
R2.02	**Hollybank, Perth Road**	**59.8**	**46.2**	**-13.6**	**Major beneficial**
R2.03	**Oakbank**	**65.5**	**46.5**	**-19.0**	**Major beneficial**
R2.04	**The Old Bakehouse, 12 Birnam Terrace**	**64.7**	**43.4**	**-21.3**	**Major beneficial**
R2.05	**9 Telford Gardens**	**62.5**	**54.5**	**-8.0**	**Major beneficial**
R2.06	Braeknowe	61.7	59.7	-2.0	Minor beneficial
R2.07	**Corbiere**	**66.1**	**68.4**	**2.3**	**Minor adverse**
R2.08	**Craigview**	**71.1**	**69.9**	**-1.2**	**Minor beneficial**

Table 16.16: Potential Short-term Night-time Impacts at Sample Receptors – Option ST2A

Reference No.	Receptor	2026 DM	2026 DS Option ST2A		
		$L_{night,outside}$ dB	$L_{night,outside}$ dB	Change	Magnitude of Impact
R2.01	West Ringwood Cottage	48.5	47.0	-1.5	Minor beneficial
R2.02	**Hollybank, Perth Road**	**47.6**	**35.3**	**-12.3**	**Major beneficial**
R2.03	**Oakbank**	**52.7**	**35.6**	**-17.1**	**Major beneficial**
R2.04	**The Old Bakehouse, 12 Birnam Terrace**	**52.0**	**32.8**	**-19.2**	**Major beneficial**
R2.05	**9 Telford Gardens**	**50.0**	**42.8**	**-7.2**	**Major beneficial**
R2.06	Braeknowe	49.3	47.5	-1.8	Minor beneficial
R2.07	**Corbiere**	**53.2**	**55.3**	**2.1**	**Minor adverse**
R2.08	**Craigview**	**57.7**	**56.6**	**-1.1**	**Minor beneficial**

Long-term Impacts

16.4.42 The operational assessment summary table for Option ST2A, in the long-term, for the daytime period is presented in Table 2 in *Appendix A16.2: Noise Assessment Summary Tables*. Option ST2A is predicted to result in a minor adverse magnitude of impact at one dwelling. A negligible adverse magnitude of impact is predicted at 313 dwellings. No change is predicted at 24 dwellings. A major beneficial magnitude of impact is predicted at 123 dwellings and a moderate beneficial magnitude of impact at 73 dwellings. A minor beneficial magnitude of impact is predicted at 58 dwellings and a negligible beneficial magnitude of impact at 190 dwellings.

16.4.43 With regards to other noise sensitive receptors, in the long-term, for the daytime period, 27 are predicted to have a negligible adverse magnitude of impact. Two are predicted to have no change. Four are predicted to have a major beneficial magnitude of impact, three are predicted to have a moderate beneficial magnitude of impact, one is predicted to have a minor beneficial magnitude of impact and eight are predicted to have a negligible beneficial magnitude of impact.

16.4.44 In the long-term, for the daytime period, the one minor adverse impact is predicted at Thistle Cottage. The other adverse impacts are predicted largely as a result of traffic growth over the long term. The majority of the predicted moderate and major beneficial noise impacts are located in Birnam and Little Dunkeld, where Option ST2A would result in large reductions in road traffic noise near to the proposed tunnel.

16.4.45 The operational assessment summary table for Option ST2A, in the long-term, for the night-time period is presented in Table 4 in *Appendix A16.2: Noise Assessment Summary Tables*. The night-time impacts are predicted to be similar to the daytime impacts summarised above.

16.4.46 The predicted changes to noise levels and the magnitude of impact at the eight sample receptors, in the long-term, for the daytime and night-time periods, are shown in Table 16.17 and Table 16.18, respectively. Receptors with beneficial impacts are highlighted with a green background and receptors with adverse impacts are highlighted with a red background. Receptors with impacts that would result in the potential for significant effects in accordance with the criteria adopted for this assessment (refer to paragraphs 16.2.57 – 58) are highlighted in bold.

Table 16.17: Potential Long-term Daytime Impacts at Sample Receptors – Option ST2A

Reference No.	Receptor	2026 DM	2041 DS Option ST2A		
		$L_{A10,18hr}$ dB	$L_{A10,18hr}$ dB	Change	Magnitude of Impact
R2.01	West Ringwood Cottage	60.9	59.4	-1.5	Negligible beneficial
R2.02	**Hollybank, Perth Road**	**59.8**	**46.6**	**-13.2**	**Major beneficial**
R2.03	**Oakbank**	**65.5**	**46.8**	**-18.7**	**Major beneficial**
R2.04	**The Old Bakehouse, 12 Birnam Terrace**	**64.7**	**43.6**	**-21.1**	**Major beneficial**
R2.05	**9 Telford Gardens**	**62.5**	**54.8**	**-7.7**	**Moderate beneficial**
R2.06	Braeknowe	61.7	60.1	-1.6	Negligible beneficial
R2.07	Corbiere	66.1	68.8	2.7	Negligible adverse
R2.08	Craigview	71.1	70.3	-0.8	Negligible beneficial

Table 16.18: Potential Long-term Night-time Impacts at Sample Receptors – Option ST2A

Reference No.	Receptor	2026 DM	2041 DS Option ST2A		
		$L_{night,outside}$ dB	$L_{night,outside}$ dB	Change	Magnitude of Impact
R2.01	West Ringwood Cottage	48.5	47.2	-1.3	Negligible beneficial
R2.02	**Hollybank, Perth Road**	**47.6**	**35.7**	**-11.9**	**Major beneficial**
R2.03	**Oakbank**	**52.7**	**35.9**	**-16.8**	**Major beneficial**
R2.04	**The Old Bakehouse, 12 Birnam Terrace**	**52.0**	**33.0**	**-19.0**	**Major beneficial**
R2.05	**9 Telford Gardens**	**50.0**	**43.1**	**-6.9**	**Moderate beneficial**
R2.06	Braeknowe	49.3	47.8	-1.5	Negligible beneficial
R2.07	Corbiere	53.2	55.7	2.5	Negligible adverse
R2.08	Craigview	57.7	57.0	-0.7	Negligible beneficial

Noise Impact from Tunnel Portals

16.4.47 The potential for increased noise levels at the north portal of the tunnel due to reflections within the tunnel have been considered. The south portal of the tunnel has not been considered due to the distance to the nearest NSR (approximately 300m). Although reflections at the north tunnel portal may increase Do-Something road traffic noise levels slightly at several of the nearest noise sensitive receptors, the Do-Something noise levels at these receptors are still predicted to be lower than the Do-Minimum noise levels and, as such, no significant adverse noise impacts are predicted due to the tunnel portals.

Operational Impacts Specific to Option ST2B

Short-term Impacts

16.4.48 The operational assessment summary table for Option ST2B, in the short-term, for the daytime period is presented in Table 5 in *Appendix A16.2: Noise Assessment Summary Tables.* Option ST2B is predicted to result in a minor adverse magnitude of impact at 101 dwellings. A negligible adverse magnitude of impact is predicted at 191 dwellings. No change is predicted at 38 dwellings. A major beneficial magnitude of impact is predicted at 48 dwellings and a moderate beneficial magnitude of impact at 52 dwellings. A minor beneficial magnitude of impact is predicted at 177 dwellings and a negligible beneficial magnitude of impact at 175 dwellings.

16.4.49 With regards to other noise sensitive receptors, in the short-term, for the daytime period, six are predicted to have a minor adverse magnitude of impact and 13 are predicted to have a negligible adverse magnitude of impact. Eight are predicted to have no change. Three are predicted to have a major beneficial magnitude of impact, five are predicted to have a minor beneficial magnitude of impact and 10 are predicted to have a negligible beneficial magnitude of impact.

16.4.50 The majority of the predicted beneficial noise impacts of minor to major magnitude are located in Birnam and Little Dunkeld, where Option ST2B would result in reductions in road traffic noise from the A9 as the dualling would be lowered in this area, and also due to the low noise road surfacing included as embedded mitigation for the dualling. The majority of the predicted adverse noise impacts of minor magnitude are located near the B867, Perth Road and the A822 (Old Military Road), where Option ST2B is predicted to result in increases in traffic flow and therefore road traffic noise on these roads. The remainder of the predicted minor adverse noise impacts are more directly due to the change in alignment, screening or road traffic of the A9.

16.4.51 The operational assessment summary table for Option ST2B, in the short-term, for the night-time period is presented in Table 7 in *Appendix A16.2: Noise Assessment Summary Tables*. The night-time impacts are predicted to be similar to the daytime impacts summarised above.

16.4.52 The predicted change in the noise levels and the magnitude of impact at the eight sample receptors, in the short-term, for the daytime and night-time periods, are shown in Table 16.19 and Table 16.20, respectively. Receptors with beneficial impacts are highlighted with a green background and receptors with adverse impacts are highlighted with a red background. Receptors with impacts that would result in the potential for significant effects in accordance with the criteria adopted for this assessment (refer to paragraphs 16.2.57 – 58) are highlighted in bold.

Table 16.19: Potential Short-term Daytime Impacts at Sample Receptors – Option ST2B

Reference No.	Receptor	2026 DM	2026 DS Option ST2B		
		$L_{A10,18hr}$ dB	$L_{A10,18hr}$ dB	Change	Magnitude of Impact
R2.01	West Ringwood Cottage	60.9	63.0	2.1	Minor adverse
R2.02	Hollybank, Perth Road	59.8	57.5	-2.3	Minor beneficial
R2.03	Oakbank	65.5	62.8	-2.7	Minor beneficial
R2.04	**The Old Bakehouse, 12 Birnam Terrace**	**64.7**	**56.7**	**-8.0**	**Major beneficial**
R2.05	9 Telford Gardens	62.5	61.0	-1.5	Minor beneficial
R2.06	Braeknowe	61.7	60.4	-1.3	Minor beneficial
R2.07	**Corbiere**	**66.1**	**68.7**	**2.6**	**Minor adverse**
R2.08	**Craigview**	**71.1**	**69.9**	**-1.2**	**Minor beneficial**

Table 16.20: Potential Short-term Night-time Impacts at Sample Receptors – Option ST2B

Reference No.	Receptor	2026 DM	2026 DS Option ST2B		
		$L_{night,outside}$ dB	$L_{night,outside}$ dB	Change	Magnitude of Impact
R2.01	West Ringwood Cottage	48.5	50.4	1.9	Minor adverse
R2.02	Hollybank, Perth Road	47.6	45.5	-2.1	Minor beneficial
R2.03	Oakbank	52.7	50.3	-2.4	Minor beneficial
R2.04	**The Old Bakehouse, 12 Birnam Terrace**	**52.0**	**44.8**	**-7.2**	**Major beneficial**
R2.05	9 Telford Gardens	50.0	48.6	-1.4	Minor beneficial
R2.06	Braeknowe	49.3	48.1	-1.2	Minor beneficial
R2.07	**Corbiere**	**53.2**	**55.6**	**2.4**	**Minor adverse**
R2.08	**Craigview**	**57.7**	**56.6**	**-1.1**	**Minor beneficial**

Long-term Impacts

16.4.53 The operational assessment summary table for Option ST2B, in the long-term, for the daytime period is presented in Table 6 in *Appendix A16.2: Noise Assessment Summary Tables.* Option ST2B is predicted to result in a minor adverse magnitude of impact at one dwelling. A negligible adverse magnitude of impact is predicted at 402 dwellings. No change is predicted at 14 dwellings. A major beneficial magnitude of impact is predicted at eight dwellings and a moderate beneficial magnitude of impact at 33 dwellings. A minor beneficial magnitude of impact is predicted at 49 dwellings and a negligible beneficial magnitude of impact at 275 dwellings.

16.4.54 With regards to other noise sensitive receptors, in the long-term, for the daytime period, 34 are predicted to have a negligible adverse magnitude of impact. One is predicted to have no change. One is predicted to have a major beneficial magnitude of impact, two are predicted to have a moderate beneficial magnitude of impact, and seven are predicted to have a negligible beneficial magnitude of impact.

16.4.55 In the long-term, for the daytime period, the one minor adverse impact is predicted at Thistle Cottage. The majority of the predicted beneficial noise impacts of minor to major magnitude are located in Birnam and Little Dunkeld, where Option ST2B would result in reductions in road traffic noise from the A9 as it would be lowered in a cutting.

16.4.56 The operational assessment summary table for Option ST2B, in the long-term, for the night-time period is presented in Table 8 in *Appendix A16.2: Noise Assessment Summary Tables*. The night-time impacts are predicted to be similar to the daytime impacts summarised above.

16.4.57 The predicted change in the noise levels and the magnitude of impact at the eight sample receptors, in the long-term, for the daytime and night-time periods, are shown in Table 16.21 and Table 16.22, respectively. Receptors with beneficial impacts are highlighted with a green background and receptors with adverse impacts are highlighted with a red background. Receptors with impacts that would have the potential to result in significant effects in accordance with the criteria adopted for this assessment (refer to paragraphs 16.2.57 – 58) are highlighted in bold.

Table 16.21: Potential Long-term Daytime Impacts at Sample Receptors – Option ST2B

Reference No.	Receptor	2026 DM	2041 DS Option ST2B		
		$L_{A10,18hr}$ dB	$L_{A10,18hr}$ dB	Change	Magnitude of Impact
R2.01	West Ringwood Cottage	60.9	63.2	2.3	Negligible adverse
R2.02	Hollybank, Perth Road	59.8	57.8	-2.0	Negligible beneficial
R2.03	Oakbank	65.5	63.2	-2.3	Negligible beneficial
R2.04	**The Old Bakehouse, 12 Birnam Terrace**	**64.7**	**57.1**	**-7.6**	**Moderate beneficial**
R2.05	9 Telford Gardens	62.5	61.3	-1.2	Negligible beneficial
R2.06	Braeknowe	61.7	60.9	-0.8	Negligible beneficial
R2.07	Corbiere	66.1	68.9	2.8	Negligible adverse
R2.08	Craigview	71.1	70.2	-0.9	Negligible beneficial

Table 16.22: Potential Long-term Night-time Impacts at Sample Receptors – Option ST2B

Reference No.	Receptor	2026 DM	2041 DS Option ST2B		
		$L_{night,outside}$ dB	$L_{night,outside}$ dB	Change	Magnitude of Impact
R2.01	West Ringwood Cottage	48.5	50.6	2.1	Negligible adverse
R2.02	Hollybank, Perth Road	47.6	45.8	-1.8	Negligible beneficial
R2.03	Oakbank	52.7	50.6	-2.1	Negligible beneficial
R2.04	**The Old Bakehouse, 12 Birnam Terrace**	**52.0**	**45.1**	**-6.9**	**Moderate beneficial**
R2.05	9 Telford Gardens	50.0	48.9	-1.1	Negligible beneficial
R2.06	Braeknowe	49.3	48.5	-0.8	Negligible beneficial
R2.07	Corbiere	53.2	55.7	2.5	Negligible adverse
R2.08	Craigview	57.7	56.9	-0.8	Negligible beneficial

Operational Impacts Specific to Option ST2C

Short-term Impacts

16.4.58 The operational assessment summary table for Option ST2C, in the short-term, for the daytime period is presented in Table 9 in *Appendix A16.2: Noise Assessment Summary Tables*. Option ST2C is predicted to result in a moderate adverse magnitude of impact at four dwellings and a minor adverse magnitude of impact at 164 dwellings. A negligible adverse magnitude of impact is predicted at 321 dwellings. No change is predicted at 31 dwellings. A moderate beneficial magnitude of impact is predicted at 14 dwellings. A minor beneficial magnitude of impact is predicted at 91 dwellings and a negligible beneficial magnitude of impact at 157 dwellings.

16.4.59 With regards to other noise sensitive receptors, in the short-term, for the daytime period, eight are predicted to have a minor adverse magnitude of impact and 18 are predicted to have a negligible adverse magnitude of impact. Five are predicted to have no change. One is predicted to have a major beneficial magnitude of impact, two are predicted to have a moderate beneficial magnitude of impact, five are predicted to have a minor beneficial magnitude of impact and six are predicted to have a negligible beneficial magnitude of impact.

16.4.60 The majority of the predicted minor to major beneficial noise impacts are located in relatively close proximity to Option ST2C and are due to the low noise road surfacing included as embedded mitigation for the dualling. The majority of the predicted minor and moderate adverse noise impacts are located near the B867, Perth Road and the A822 (Old Military Road), where Option ST2C is predicted to result in increases in traffic flow and therefore road traffic noise on these roads. The remainder of the predicted minor and moderate adverse noise impacts are more directly due to the change in alignment, screening or road traffic of the A9.

16.4.61 The operational assessment summary table for Option ST2C, in the short-term, for the night-time period is presented in Table 11 in *Appendix A16.2: Noise Assessment Summary Tables*. The night-time impacts are predicted to be similar to the daytime impacts summarised above.

16.4.62 The predicted change in the noise levels and the magnitude of impact at the eight sample receptors, in the short-term, for the daytime and night-time periods, are shown in Table 16.23 and Table 16.24, respectively. Receptors with beneficial impacts are highlighted with a green background and receptors with adverse impacts are highlighted with a red background. Receptors with impacts that would have the potential to result in significant effects in accordance with the criteria adopted for this assessment (refer to paragraphs 16.2.57 – 58) are highlighted in bold.

Table 16.23: Potential Short-term Daytime Impacts at Sample Receptors – Option ST2C

Reference No.	Receptor	2026 DM	2026 DS Option ST2C		
		$L_{A10,18hr}$ dB	$L_{A10,18hr}$ dB	Change	Magnitude of Impact
R2.01	West Ringwood Cottage	60.9	63.1	2.2	Minor Adverse
R2.02	Hollybank, Perth Road	59.8	57.4	-2.4	Minor Beneficial
R2.03	Oakbank	65.5	64.9	-0.6	Negligible Beneficial
R2.04	The Old Bakehouse, 12 Birnam Terrace	64.7	63.7	-1.0	Minor Beneficial
R2.05	9 Telford Gardens	62.5	62.8	0.3	Negligible Adverse
R2.06	**Braeknowe**	**61.7**	**66.2**	**4.5**	**Moderate Adverse**
R2.07	**Corbiere**	**66.1**	**62.5**	**-3.6**	**Moderate Beneficial**
R2.08	**Craigview**	**71.1**	**69.5**	**-1.6**	**Minor Beneficial**

Table 16.24: Potential Short-term Night-time Impacts at Sample Receptors – Option ST2C

Reference No.	Receptor	2026 DM	2026 DS Option ST2C		
		$L_{night,outside}$ dB	$L_{night,outside}$ dB	Change	Magnitude of Impact
R2.01	West Ringwood Cottage	48.5	50.5	2.0	Minor adverse
R2.02	Hollybank, Perth Road	47.6	45.4	-2.2	Minor beneficial
R2.03	Oakbank	52.7	52.1	-0.6	Negligible beneficial
R2.04	The Old Bakehouse, 12 Birnam Terrace	52.0	51.1	-0.9	Negligible beneficial
R2.05	9 Telford Gardens	50.0	50.3	0.3	Negligible adverse
R2.06	**Braeknowe**	**49.3**	**53.3**	**4.0**	**Moderate adverse**
R2.07	**Corbiere**	**53.2**	**50.0**	**-3.2**	**Moderate beneficial**
R2.08	**Craigview**	**57.7**	**56.3**	**-1.4**	**Minor beneficial**

Long-term Impacts

16.4.63 The operational assessment summary table for Option ST2C, in the long-term, for the daytime period is presented in Table 10 in *Appendix A16.2: Noise Assessment Summary Tables*. Option ST2C is predicted to result in a minor adverse magnitude of impact at four dwellings. A negligible adverse magnitude of impact is predicted at 570 dwellings. No change is predicted at 18 dwellings. A minor beneficial magnitude of impact is predicted at ten dwellings and a negligible beneficial magnitude of impact at 180 dwellings.

16.4.64 With regards to other noise sensitive receptors, in the long-term, for the daytime period, 34 are predicted to have a negligible adverse magnitude of impact. One is predicted to have a moderate beneficial magnitude of impact, two are predicted to have a minor beneficial magnitude of impact and eight are predicted to have a negligible beneficial magnitude of impact.

16.4.65 In the long-term, for the daytime period, the four minor adverse impacts predicted are in the vicinity of the proposed Dunkeld Junction. The predicted minor and moderate beneficial noise impacts are due to changes such as alignment or screening of the A9.

16.4.66 The operational assessment summary table for Option ST2C, in the long-term, for the night-time period is presented in Table 12 in *Appendix A16.2: Noise Assessment Summary Tables*. The night-time impacts are predicted to be similar to the daytime impacts summarised above.

16.4.67 The predicted change in the noise levels and the magnitude of impact at the eight sample receptors, in the long-term, for the daytime and night-time periods, are shown in Table 16.25 and Table 16.26, respectively. Receptors with beneficial impacts are highlighted with a green background and receptors with adverse impacts are highlighted with a red background. Receptors with impacts that would have the potential to result in significant effects in accordance with the criteria adopted for this assessment (refer to paragraphs 16.2.57 – 58) are highlighted in bold.

Table 16.25: Potential Long-term Daytime Impacts at Sample Receptors – Option ST2C

Reference No.	Receptor	2026 DM	2041 DS Option ST2C		
		$L_{A10,18hr}$ dB	$L_{A10,18hr}$ dB	Change	Magnitude of Impact
R2.01	West Ringwood Cottage	60.9	63.3	2.4	Negligible adverse
R2.02	Hollybank, Perth Road	59.8	57.7	-2.1	Negligible beneficial
R2.03	Oakbank	65.5	65.2	-0.3	Negligible beneficial
R2.04	The Old Bakehouse, 12 Birnam Terrace	64.7	64.0	-0.7	Negligible beneficial
R2.05	9 Telford Gardens	62.5	63.1	0.6	Negligible adverse
R2.06	Braeknowe	61.7	66.5	4.8	Minor adverse
R2.07	Corbiere	66.1	62.8	-3.3	Minor beneficial
R2.08	Craigview	71.1	69.8	-1.3	Negligible beneficial

Table 16.26: Potential Long-term Night-time Impacts at Sample Receptors – Option ST2C

Reference No.	Receptor	2026 DM	2041 DS Option ST2C		
		$L_{night,outside}$ dB	$L_{night,outside}$ dB	Change	Magnitude of Impact
R2.01	West Ringwood Cottage	48.5	50.7	2.2	Negligible adverse
R2.02	Hollybank, Perth Road	47.6	45.7	-1.9	Negligible beneficial
R2.03	Oakbank	52.7	52.4	-0.3	Negligible beneficial
R2.04	The Old Bakehouse, 12 Birnam Terrace	52.0	51.3	-0.7	Negligible beneficial
R2.05	9 Telford Gardens	50.0	50.5	0.5	Negligible adverse
R2.06	Braeknowe	49.3	53.6	4.3	Minor adverse
R2.07	Corbiere	53.2	50.3	-2.9	Negligible beneficial
R2.08	Craigview	57.7	56.6	-1.1	Negligible beneficial

Operational Impacts Specific to Option ST2D

Short-term Impacts

16.4.68 The operational assessment summary table for Option ST2D, in the short-term, for the daytime period is presented in Table 13 in *Appendix A16.2: Noise Assessment Summary Tables*. Option ST2D is predicted to result in a minor adverse magnitude of impact at 151 dwellings. A negligible adverse magnitude of impact is predicted at 322 dwellings. No change is predicted at 40 dwellings. A moderate beneficial magnitude of impact is predicted at eight dwellings. A minor beneficial magnitude of impact is predicted at 82 dwellings and a negligible beneficial magnitude of impact at 179 dwellings.

16.4.69 With regards to other noise sensitive receptors, in the short-term, for the daytime period, eight are predicted to have a minor adverse magnitude of impact and 18 are predicted to have a negligible adverse magnitude of impact. Seven are predicted to have no change. One is predicted to have a major beneficial magnitude of impact, three are predicted to have a minor beneficial magnitude of impact and eight are predicted to have a negligible beneficial magnitude of impact.

16.4.70 The majority of the predicted minor to major beneficial noise impacts are located in relatively close proximity to Option ST2D and are due to the low noise road surfacing included as embedded mitigation. The majority of the predicted minor adverse noise impacts are located near the B867, Perth Road and the A822, where Option ST2D is predicted to result in increases in traffic flow and therefore road traffic noise on these roads. The remainder of the predicted minor adverse noise impacts are more directly due to the change in alignment, screening or road traffic of the A9.

16.4.71 The operational assessment summary table for Option ST2D, in the short-term, for the night-time period is presented in Table 15 in *Appendix A16.2: Noise Assessment Summary Tables*. The night-time impacts are predicted to be similar to the daytime impacts summarised above.

16.4.72 The predicted change in the noise levels and the magnitude of impact at the eight sample receptors, in the short-term, for the daytime and night-time periods, are shown in Table 16.27 and Table 16.28, respectively. Receptors with beneficial impacts are highlighted with a green background and receptors with adverse impacts are highlighted with a red background. Receptors with impacts that would have the potential to result in significant effects in accordance with the criteria adopted for this assessment (refer to paragraphs 16.2.57 – 58) are highlighted in bold.

Table 16.27: Potential Short-term Daytime Impacts at Sample Receptors – Option ST2D

Reference No.	Receptor	2026 DM	2026 DS Option ST2D		
		$L_{A10,18hr}$ dB	$L_{A10,18hr}$ dB	Change	Magnitude of Impact
R2.01	West Ringwood Cottage	60.9	63.0	2.1	Minor adverse
R2.02	Hollybank, Perth Road	59.8	57.4	-2.4	Minor beneficial
R2.03	Oakbank	65.5	65.0	-0.5	Negligible beneficial
R2.04	The Old Bakehouse, 12 Birnam Terrace	64.7	64.0	-0.7	Negligible beneficial
R2.05	9 Telford Gardens	62.5	61.7	-0.8	Negligible beneficial
R2.06	Braeknowe	61.7	60.8	-0.9	Negligible beneficial
R2.07	**Corbiere**	**66.1**	**68.5**	**2.4**	**Minor adverse**
R2.08	**Craigview**	**71.1**	**70.0**	**-1.1**	**Minor beneficial**

Table 16.28: Potential Short-term Night-time Impacts at Sample Receptors – Option ST2D

Reference No.	Receptor	2026 DM	2026 DS Option ST2D		
		$L_{night,outside}$ dB	$L_{night,outside}$ dB	Change	Magnitude of Impact
R2.01	West Ringwood Cottage	48.5	50.4	1.9	Minor adverse
R2.02	Hollybank, Perth Road	47.6	45.4	-2.2	Minor beneficial
R2.03	Oakbank	52.7	52.2	-0.5	Negligible beneficial
R2.04	The Old Bakehouse, 12 Birnam Terrace	52.0	51.3	-0.7	Negligible beneficial
R2.05	9 Telford Gardens	50.0	49.3	-0.7	Negligible beneficial
R2.06	Braeknowe	49.3	48.5	-0.8	Negligible beneficial
R2.07	**Corbiere**	**53.2**	**55.4**	**2.2**	**Minor adverse**
R2.08	**Craigview**	**57.7**	**56.7**	**-1.0**	**Minor beneficial**

Long-term Impacts

16.4.73 The operational assessment summary table for Option ST2D, in the long-term, for the daytime period is presented in Table 14 in *Appendix A16.2: Noise Assessment Summary Tables*. Option ST2D is predicted to result in a minor adverse magnitude of impact at one dwelling. A negligible adverse magnitude of impact is predicted at 565 dwellings. No change is predicted at 18 dwellings. A minor beneficial magnitude of impact is predicted at five dwellings and a negligible beneficial magnitude of impact at 193 dwellings.

16.4.74 With regards to other noise sensitive receptors, in the long-term, for the daytime period, 38 are predicted to have a negligible adverse magnitude of impact. One is predicted to have a moderate beneficial magnitude of impact and five are predicted to have a negligible beneficial magnitude of impact.

16.4.75 In the long-term, for the daytime period, the predicted minor adverse impact is predicted at Thistle Cottage. The predicted minor and moderate beneficial noise impacts are due to factors such as the change in alignment or screening of the A9.

16.4.76 The operational assessment summary table for Option ST2D, in the long-term, for the night-time period is presented in Table 16 in *Appendix A16.2: Noise Assessment Summary Tables*. The night-time impacts are predicted to be similar to the daytime impacts summarised above.

16.4.77 The predicted change in the noise levels and the magnitude of impact at the eight sample receptors, in the long-term, for the daytime and night-time periods, are shown in Table 16.29 and Table 16.30, respectively. Receptors with beneficial impacts are highlighted with a green background and receptors with adverse impacts are highlighted with a red background. Receptors with impacts that would have the potential to result in significant effects in accordance with the criteria adopted for this assessment (refer to paragraphs 16.2.57 – 58) are highlighted in bold.

Table 16.29: Potential Long-term Daytime Impacts at Sample Receptors – Option ST2D

Reference No.	Receptor	2026 DM	2041 DS Option ST2D		
		$L_{A10,18hr}$ dB	$L_{A10,18hr}$ dB	Change	Magnitude of Impact
R2.01	West Ringwood Cottage	60.9	63.2	2.3	Negligible adverse
R2.02	Hollybank, Perth Road	59.8	57.7	-2.1	Negligible beneficial
R2.03	Oakbank	65.5	65.3	-0.2	Negligible beneficial
R2.04	The Old Bakehouse, 12 Birnam Terrace	64.7	64.4	-0.3	Negligible beneficial
R2.05	9 Telford Gardens	62.5	62.0	-0.5	Negligible beneficial
R2.06	Braeknowe	61.7	61.2	-0.5	Negligible beneficial
R2.07	Corbiere	66.1	68.8	2.7	Negligible adverse
R2.08	Craigview	71.1	70.3	-0.8	Negligible beneficial

Table 16.30: Potential Long-term Night-time Impacts at Sample Receptors – Option ST2D

Reference No.	Receptor	2026 DM	2041 DS Option ST2D		
		$L_{A10,18hr}$ dB	$L_{A10,18hr}$ dB	Change	Magnitude of Impact
R2.01	West Ringwood Cottage	48.5	50.6	2.1	Negligible adverse
R2.02	Hollybank, Perth Road	47.6	45.7	-1.9	Negligible beneficial
R2.03	Oakbank	52.7	52.5	-0.2	Negligible beneficial
R2.04	The Old Bakehouse, 12 Birnam Terrace	52.0	51.7	-0.3	Negligible beneficial
R2.05	9 Telford Gardens	50.0	49.5	-0.5	Negligible beneficial
R2.06	Braeknowe	49.3	48.8	-0.5	Negligible beneficial
R2.07	Corbiere	53.2	55.7	2.5	Negligible adverse
R2.08	Craigview	57.7	57.0	-0.7	Negligible beneficial

Significance of Effect

16.4.78 An assessment of the potential significance of effects has been carried out using the criteria detailed in paragraphs 16.2.57 – 58. Analysis of the predicted noise levels in the assessment scenarios and the resultant change in noise levels has been undertaken for all of the noise sensitive receptors within the noise model study area.

16.4.79 Tables 16.31 – Table 16.34 present a summary of the number of NSRs (dwellings and other sensitive receptors) that meet the significance criteria adopted in this assessment, in terms of meeting the absolute noise level thresholds (LOAEL and SOAEL) and the required noise change to result in a potential significant effect, in both the short-term and long-term and in the daytime and night-time scenarios. The number of NSRs meeting the significant criteria varies between proposed route options and the scenarios, so the total presented also varies between proposed route options and scenarios.

Table 16.31: Potential Significance of Effect Assessment – Short-term Daytime

	Number of NSRs Meeting Potential Significance Criteria in the Short-term during the Daytime for each Proposed Route Option							
	Option ST2A		Option ST2B		Option ST2C		Option ST2D	
	Adverse	Beneficial	Adverse	Beneficial	Adverse	Beneficial	Adverse	Beneficial
>SOAEL	3	12	4	12	14	11	10	10
LOAEL<X<SOAEL	0	222	0	87	4	12	0	5
Total	**3**	**234**	**4**	**99**	**18**	**23**	**10**	**15**

Table 16.32: Potential Significance of Effect Assessment – Short-term Night-time

	Number of NSRs Meeting Potential Significance Criteria in the Short-term during the Night-time for each Proposed Route Option							
	Option ST2A		Option ST2B		Option ST2C		Option ST2D	
	Adverse	Beneficial	Adverse	Beneficial	Adverse	Beneficial	Adverse	Beneficial
>SOAEL	3	12	4	12	14	11	10	9
LOAEL<X<SOAEL	0	236	0	84	4	9	0	3
Total	**3**	**248**	**4**	**96**	**18**	**20**	**10**	**12**

Table 16.33: Potential Significance of Effect Assessment – Long-term Daytime

	Number of NSRs Meeting Potential Significance Criteria in the Long-term during the Daytime for each Proposed Route Option							
	Option ST2A		Option ST2B		Option ST2C		Option ST2D	
	Adverse	Beneficial	Adverse	Beneficial	Adverse	Beneficial	Adverse	Beneficial
>SOAEL	1	9	1	7	0	2	1	0
LOAEL<X<SOAEL	0	187	0	44	0	1	0	1
Total	**1**	**196**	**1**	**51**	**0**	**3**	**1**	**1**

Table 16.34: Potential Significance of Effect Assessment – Long-term Night-time

	Number of NSRs Meeting Potential Significance Criteria in the Long-term during the Night-time for each Proposed Route Option							
	Option ST2A		Option ST2B		Option ST2C		Option ST2D	
	Adverse	Beneficial	Adverse	Beneficial	Adverse	Beneficial	Adverse	Beneficial
>SOAEL	0	9	0	7	0	2	0	0
LOAEL<X<SOAEL	0	176	0	29	0	0	0	0
Total	**0**	**185**	**0**	**36**	**0**	**2**	**0**	**0**

16.4.80 Table 16.35 presents a summary of the number of NSRs that meet the criteria for potential significant effects adopted in this assessment in at least one of the four scenarios considered in Tables 16.31 – 16.34. In Table 16.35, an NSR is counted once even if it meets the criteria in more than one of the four scenarios. The locations of NSRs that meet the criteria for the potential significant effects adopted in this assessment are presented in Figures 16.2a-d.

Table 16.35: Potential Significance of Effect Assessment – Summary

	Number of NSRs Meeting Potential Significance Criteria in any Scenario for each Proposed Route Option							
	Option ST2A		Option ST2B		Option ST2C		Option ST2D	
	Adverse	Beneficial	Adverse	Beneficial	Adverse	Beneficial	Adverse	Beneficial
Total	3	259	4	100	18	23	10	15

16.4.81 Table 16.35 shows that Option ST2A is expected to have the greatest number of potential significant beneficial effects and the least number of potential significant adverse effects. Option ST2B is expected to have the second greatest number of potential significant beneficial effects and a similar number of potential significant adverse effects as Option ST2A. Options ST2C and ST2D are expected to have the least number of potential significant beneficial effects and the greatest number of potential significant adverse effects; for both proposed route options, the number of potential significant beneficial effects is expected to be greater than the number of potential significant adverse effects.

16.5 Potential Mitigation

16.5.1 Mitigation measures for the proposed route options in relation to noise and vibration take into account best practice, legislation, guidance and professional experience. This section makes reference to overarching standard measures applicable across A9 dualling projects, and also to noise-specific mitigation for the proposed route options for the Pass of Birnam to Tay Crossing Project. Embedded mitigation for the proposed route options are described in Section 16.4 (Potential Impacts and Effects).

Standard Mitigation

16.5.2 A Construction Environmental Management Plan (CEMP) would be prepared by the Contractor. The CEMP would set out how the Contractor intends to operate the construction site, including construction-related mitigation measures. The relevant section(s) of the CEMP would be in place prior to the start of construction work and would cover a range of aspects including noise and vibration.

16.5.3 Prior to construction, a suitably qualified Environmental Clerk of Works (EnvCoW) would be appointed by the Contractor. The EnvCoW(s) would be present on-site, as required, during the construction period to monitor the implementation of the mitigation measures identified and ensure that activities are carried out in such a manner to prevent or reduce impacts on the environment. This would involve the EnvCoW(s) ensuring the Contractor is adhering to the best practicable means mitigation measures set out in paragraph 16.5.8.

16.5.4 An assessment of construction noise and vibration impacts has been completed based on the level of detail undertaken at this time (see Volume 1, Part 2 - Engineering Assessment). This would be further refined and considered at DMRB Stage 3 as a more detailed constructability assessment is undertaken. A plan for noise and vibration monitoring would be agreed with the relevant Environmental Health Department, and noise and vibration limits would be contained within the CEMP. The Contractor would be required to develop and implement a Noise and Vibration Management Plan to meet these requirements. The assessment would include the design of any necessary NSR specific construction mitigation over and above the standard mitigation that would be included at DMRB Stage 3.

16.5.5 The following mitigation measures, as recommended in BS 5228-1, would be employed to minimise the noise impacts during the construction phase:

Community Relations

16.5.6 The Contractor would contribute towards the overall communications strategy for the A9 Dualling Programme throughout the construction period, which would assist in mitigation of noise and vibration, for example by providing forewarning of impending noisy activities and a feedback mechanism for any concerns to be raised. As part of the communications strategy the Contractor would appoint a community liaison officer supported by a liaison team as necessary who would:

- liaise with the following: relevant local authorities; other statutory bodies and regulatory authorities; community councils and relevant community groups; and businesses and residents in local communities affected by the construction works;
- notify occupiers of nearby properties a minimum of two weeks in advance of the nature and anticipated duration of planned construction works that may affect them;
- support the production of project communications such as the project website and newsletters; and
- establish a dedicated freephone telephone helpline together with a dedicated email address and postal address for enquiries and complaints during the construction phase. The relevant contact numbers, email and postal addresses would as a minimum be displayed on signs around the construction site and would be published on the project website. Enquiries and complaints would be logged in a register and appropriate action would be taken in response to any complaints.

Training of Employees

16.5.7 The Contractor would ensure that all site workers receive adequate environmental training relevant to their role prior to working on the construction site, including specific environmental project inductions and 'toolbox talks' on best practice construction methods as appropriate, which would be anticipated to include those relating to noise and vibration control, by employing techniques to keep site noise to a minimum, and would be effectively supervised to ensure that best working practice in respect of noise reduction is followed.

Execution of Works

16.5.8 Best practicable means would be used to limit the level of noise to which operators and others in the vicinity of site operations would be exposed. This includes the following:

- the hours of working would be planned, and account would be taken of the effects of noise upon persons in areas surrounding site operations and upon persons working on-site, taking into account the nature of land use in the areas concerned, the duration of work and the likely consequence of any lengthening of work periods;
- any work outside of normal working hours would be agreed with the relevant local authority;
- where reasonably practicable, quiet working methods would be employed, including use of the most suitable plant, reasonable hours of working for noisy operations, and economy and speed of operations;
- permanent noise mitigation measures such as acoustic screens and earthwork bunds are to be constructed as early as practical;
- noise would be controlled at source, for example, by modification of existing plant/equipment, its use and location and ensuring maintenance of all noise-generating equipment;
- the spread of noise would be limited, i.e. by distance between source and receiver and/or screening;
- on-site noise levels would be monitored regularly, particularly if changes in machinery or project designs are introduced, by a suitably qualified person appointed specifically for the purpose. A method of noise measurement would be agreed prior to the commencement of site works;
- on those parts of a site where high levels of noise are likely to be a hazard to persons working on the site, prominent warning notices would be displayed and, where necessary, ear protectors would be provided;
- proper use of plant with respect to minimising noise emissions and regular maintenance in line with plant manuals;
- where practicable, vehicles and mechanical plant used for the purpose of the works would be fitted with effective exhaust silencers and would be maintained in good, efficient working order;
- where appropriate, inherently quiet plant would be selected. All major compressors would be 'sound reduced' models fitted with properly lined and sealed acoustic covers which would be kept closed whenever the machines are in use and all ancillary pneumatic percussive tools would be fitted with mufflers or silencers of the type recommended by the manufacturers;
- machines in intermittent use would be shut down in the intervening periods between work or throttled down to a minimum;
- all ancillary plant such as generators, compressors and pumps would be positioned to cause minimum noise disturbance. If necessary, acoustic barriers or enclosures would be provided; and
- adherence to the codes of practice for construction working and piling given in British Standard BS 5228-1 and the guidance given therein minimising noise emissions from the site.

16.5.9 In addition, PKC would be consulted regarding any proposed working outwith normal working hours. PKC have indicated that for any approved works outwith normal working hours, the noisiest part of these works should be undertaken as close to normal working hours as practicable.

Specific Mitigation

Specific Mitigation for Construction Vibration

16.5.10 Prior to construction works commencing, a structural survey of buildings within 10-15m of the proposed cut and cover tunnel of Option ST2A, underpass of Option ST2B, the pedestrian underpass to Dunkeld & Birnam Station of Option ST2C and Option ST2D and any other piling or vibration generating activity would be undertaken to ascertain the structural condition of the buildings.

16.5.11 Once the structural assessments have been undertaken, consideration of vibration limit values and compliance measurement would be required, with the requirement to undertake vibration measurement whilst the works are within a certain distance. For piling activities undertaken near Dunkeld & Birnam Station, it is possible that Network Rail may require vibration measurements and a watching brief throughout the works due to the proximity of the Highland Main Line railway.

16.5.12 The following mitigation measures could be employed to reduce the impacts of vibration upon sensitive receptors:

- use of 'soft-start' piling techniques to reduce the vibration impacts generated by start-up and ramp down of the piling rig;
- pre-augering or pre-excavation of pile route to remove obstructions and reduce the potential for high vibration events and increase the rate of pile insertion; and
- where vibratory piling is proposed, use percussive piling or an alternative method of piling (such as press piling) for piling near to sensitive buildings or structures.

16.5.13 The efficacy of such measures is not well understood; however, these forms of mitigation have been widely used where piling works take place close to sensitive receptors, where they have successfully reduced the level of vibration measured and the consequential level of complaint.

Specific Mitigation for Operational Noise

16.5.14 Table 16.35 shows the number of NSRs that are predicted to experience potential significant adverse effects, based on the initial significance criteria developed for the purposes of the route option appraisal. Figures 16.2a-d presents the location of these NSRs, along with the NSRs that are predicted to experience potential significant beneficial effects.

16.5.15 As stated in paragraph 16.2.7, this noise assessment focusses on building façades which face the scheme or the nearest affected route, rather than considering noise changes on all façades of the buildings. However, at DMRB Stage 3, the requirements for mitigation would be considered in accordance with the principles set out in DMRB LA 111, which will include consideration of all façades.

16.5.16 Where a potential significant adverse effect is predicted at an NSR, then additional NSR specific mitigation has been considered. The locations of the NSRs where exceedances of the noise mitigation criteria are predicted are presented in Table 16.36. Potential additional NSR specific mitigation and the resulting NSRs where exceedances of the noise mitigation criteria are residually predicted are also presented in Table 16.36.

Table 16.36: Locations of the NSRs where Potential Significant Adverse Effects are Predicted

Location	Number of NSRs with Potential Significant Effects, without Mitigation				Description of Potential Mitigation	Indicative Number of NSRs with Potential Significant Effects, with Mitigation			
	Option ST2A	Option ST2B	Option ST2C	Option ST2D		Option ST2A	Option ST2B	Option ST2C	Option ST2D
Properties on Perth Road (north of Station Road)	2	2	1	2	Potential significant adverse effects are predicted for all proposed route options due to predicted increases in traffic flows on Perth Road. Generally, such an increase in traffic noise could be mitigated by acoustic barriers. However, such mitigation would not be practicable as any acoustic barrier would be necessary at the frontage of properties, and to provide access to properties, the barrier would not be continuous. Consideration has been given to reducing the speed limit on Perth Road to 20mph. While noise modelling suggests the noise impact may be reduced, this would need to be considered further at DMRB Stage 3, in consultation with PKC, and has not been included at this stage.	2	2	1	2
Properties on Perth Road (south of Station Road)	0	0	13	6	Potential significant adverse effects are predicted for Options ST2C and ST2D due to the predicted increases in traffic flows on Perth Road. Generally, such an increase in traffic noise on Perth Road could be mitigated by acoustic barriers. However, such mitigation would not be practicable as any acoustic barrier would be necessary at the frontage of properties on Perth Road, and there is no space between the properties, pavement and Perth Road for an acoustic barrier. Consideration has been given to reducing the speed limit on Perth Road to 20mph. While noise modelling suggests the noise impact may be reduced, this would need to be considered further at DMRB Stage 3, in consultation with PKC, and has not been included at this stage.	0	0	13	6

Location	Number of NSRs with Potential Significant Effects, without Mitigation				Description of Potential Mitigation	Indicative Number of NSRs with Potential Significant Effects, with Mitigation			
	Option ST2A	Option ST2B	Option ST2C	Option ST2D		Option ST2A	Option ST2B	Option ST2C	Option ST2D
Properties on King Duncan's Place	0	0	2	0	Potential significant adverse effects are predicted for Option ST2C, due to changes in topography as part of the Dunkeld Junction, which would reduce the existing screening of the A9. A barrier approximately 1.5m high and 30m in length along the scheme earthworks beside the southbound carriageway is predicted to reduce noise levels to below significant levels.	0	0	0	0
Braeknowe (Sample Receptor R2.06)	0	0	1	0	Potential significant adverse effects are predicted for Option ST2C due to changes in topography as part of the Dunkeld Junction which would reduce the existing screening of the A9. A barrier approximately 2.5m high and 100m in length along the scheme earthworks beside the northbound carriageway, **or** a barrier approximately 4m high and 17m in length along the property boundary is predicted to reduce noise levels to below significant levels.	0	0	0	0
Ladywell	0	0	1	0	Potential significant adverse effects are predicted for Option ST2C due to changes in topography as part of the Dunkeld Junction which would reduce the existing screening of the A9. A barrier approximately 3.5m high and 36m in length along the property boundary is predicted to reduce noise levels to below significant levels.	0	0	0	0
Corbiere (Sample Receptor R2.07) and Braan Cottage	1	2	0	2	Potential significant adverse effects are predicted for Options ST2A, ST2B and ST2D due to predicted increases in traffic flows and speed on A923 as it passes Corbiere and Braan Cottage. A barrier approximately 0.5m high and 15m in length along scheme earthworks beside the A923 is predicted to reduce noise levels to below significant levels.	0	0	0	0
Total	**3**	**4**	**18**	**10**		**2**	**2**	**14**	**8**

16.5.17 As shown in Table 16.36, where required for King Duncan's Place, Braeknowe, Ladywell, Corbiere and Braan Cottage, NSR specific mitigation in the form of a noise barrier, wall and/or an earthworks bund would be considered at DMRB Stage 3 to reduce road traffic noise levels at these properties such that significant adverse effects do not occur.

16.5.18 Analysis of the predicted noise levels at the remaining NSRs where potential significant adverse effects are predicted shows that, except for at one location (Thistle Cottage on Perth Road), they are occurring in the short-term only and are caused by strategic traffic flow changes on Perth Road. The noise level contribution from these roads at these NSR is predicted to be more than 10dB above that from the A9 carriageway of the proposed route options, and therefore any reduction in noise from the proposed route options would have a negligible effect on the absolute noise levels experienced at these NSR. This is due to the logarithmic relationship of decibels and how noise levels from different noise sources combine to give a resulting total noise level at a receptor.

16.5.19 For residential properties on Perth Road, NSR specific mitigation, in the form of changes to the proposed route option design, road signing strategy and road speed limit may be considered at DMRB Stage 3 to reduce traffic flow and therefore road traffic noise levels on Perth Road such that significant adverse effects do not occur.

16.6 Summary of Route Options Assessment

16.6.1 This section provides a summary of the DMRB Stage 2 assessment for the proposed route options.

16.6.2 For the comparison of proposed route options, two aspects are considered; whether the potential for any residual effects would be considered significant in the context of the EIA Regulations, and whether any of the potential impacts and effects identified differ sufficiently between proposed route options such that they can be considered a differentiator and need to be considered as part of the overall identification of the Preferred Route Option which, as explained in Volume 1, Part 3 – Environmental Assessment (Chapter 7 - Overview of Environmental Assessment), takes into account environmental, engineering, economic and traffic considerations.

Construction

16.6.3 It is considered that the differences in construction noise impacts can be used to differentiate between the proposed route options. Option ST2A is considered likely to result in the greatest number of significant construction noise effects, as it is expected to have the longest duration of high noise levels at NSR properties, due to the construction of the cut and cover tunnel, as well as the longest overall construction duration during which noise impacts would be experienced. Option ST2B is considered to be intermediate, as it is expected to have the second longest period of high construction noise levels at NSR properties, due to the construction of the underpass, and the second longest overall construction period. Options ST2C and ST2D are considered likely to result in the least number of significant construction noise effects as they are expected to have the shortest periods of high noise levels at NSR properties. This is largely due to less substantial piling operations being required and because they have the shortest overall construction duration. Option ST2D is considered to be less likely to result in less significant construction noise effects than Option ST2C because it includes an at-grade junction at Dunkeld, compared to the grade separated junction for Option ST2C, which would require more extensive earthworks, nearer to NSRs.

16.6.4 It is considered that the differences in construction vibration impacts cannot be used to differentiate between the proposed route options because, when mitigation is taken into consideration, the likelihood of significant vibration effects is considered to be low for all proposed route options.

16.6.5 Overall, the difference in construction noise and vibration impacts between proposed route options is considered to be a differentiator, with Options ST2C and ST2D considered likely to have the lowest overall effects, Option ST2B considered likely to have the second highest overall effects and Option ST2A considered likely to have the highest overall effects, as shown in Table 16.42.

Operation

16.6.6 The DMRB Stage 2 assessment of road traffic noise has identified a number of potential significant effects (refer to Section 16.4). The differences between predicted potential significant adverse effects, both with and without mitigation, between the proposed route options are considered to be a differentiator, with Options ST2A and ST2B predicted to have the lowest number of potential adverse effects, Option ST2D predicted to have the second highest number of potential adverse effects and Option ST2C predicted to have the highest number of potential adverse effects. In addition, the differences between predicted potential significant beneficial effects between the proposed route options are considered to be a differentiator, with Options ST2A predicted to have the highest number of potential beneficial effects, Option ST2B predicted to have the second highest number of potential beneficial effects and Options ST2C and ST2D predicted to have the lowest number of potential beneficial effects.

16.6.7 The DMRB Stage 2 assessment of road traffic noise has identified potential adverse and beneficial noise impacts associated with the proposed route options as shown in Tables 16.37 to 16.40. Beneficial impacts are highlighted with a green background and adverse impacts are highlighted with a red background. The differences between predicted potential significant adverse and beneficial effects between the proposed route options are considered to be a differentiator, with Option ST2A considered to have the lowest overall adverse effects, Option ST2B the second lowest overall adverse effects and Options ST2C and ST2D the highest overall adverse effects, as shown in Table 16.43.

Table 16.37: Summary of Assessment – Operational Noise in the Short-term (Daytime)

Chapter/Subcategory/ Receptor/Magnitude of Impact				Number of Receptors				Comments
				Option ST2A	Option ST2B	Option ST2C	Option ST2D	
Noise and Vibration	Operation	Dwellings	Negligible adverse	163	191	321	322	Option ST2A results in the fewest potential significant adverse effects (three) and most potential significant beneficial effects (234) in the short-term during daytime, as 1.5km of this proposed route option is in a tunnel as it passes Birnam and consequently noise impacts along this section during operation are largely beneficial. Options ST2C and ST2D result in the most potential significant adverse effects (18 and 10, respectively) and fewest potential significant beneficial effects (23 and 15, respectively) in the short-term during daytime. The difference between predicted potential significant adverse and beneficial effects in the short-term during daytime between the proposed route options is considered to be a differentiator, with Option ST2A the lowest overall adverse effects and Options ST2C and ST2D the highest overall adverse effects.
			Minor adverse	66	101	164	151	
			Moderate adverse	0	0	4	0	
			Major adverse	0	0	0	0	
			No Impact	34	38	31	40	
			Negligible beneficial	131	175	157	179	
			Minor beneficial	118	177	91	82	
			Moderate beneficial	64	52	14	8	
			Major beneficial	206	48	0	0	
		Other Noise Sensitive Receptors	Negligible adverse	14	13	18	18	
			Minor adverse	6	6	8	8	
			Moderate adverse	0	0	0	0	
			Major adverse	0	0	0	0	
			No Impact	5	8	5	7	
			Negligible beneficial	10	10	6	8	
			Minor beneficial	2	5	5	3	
			Moderate beneficial	1	0	2	0	
			Major beneficial	7	3	1	1	

Table 16.38: Summary of Assessment – Operational Noise in the Long-term (Daytime)

Chapter/Subcategory/ Receptor/Magnitude of Impact				Number of Receptors				Comments
				Option ST2A	Option ST2B	Option ST2C	Option ST2D	
Noise and Vibration	Operation	Dwellings	Negligible adverse	313	402	570	565	Option ST2A results in the most potential significant beneficial effects (196) in the long-term during daytime, as 1.5km of this proposed route option is in a tunnel as it passes Birnam and consequently noise impacts along this section during operation are largely beneficial. Options ST2C and ST2D result in the fewest potential significant beneficial effects (3 and 1, respectively) in the long-term during daytime. No potential significant adverse effects are predicted in the long-term during daytime for all proposed route options. The difference between predicted potential significant adverse and beneficial effects in the long-term during daytime between the proposed route options is considered to be a differentiator, with Option ST2A the lowest overall adverse effects and Options ST2C and ST2D the highest overall adverse effects.
			Minor adverse	1	1	4	1	
			Moderate adverse	0	0	0	0	
			Major adverse	0	0	0	0	
			No Impact	24	14	18	18	
			Negligible beneficial	190	275	180	193	
			Minor beneficial	58	49	10	5	
			Moderate beneficial	73	33	0	0	
			Major beneficial	123	8	0	0	
		Other Noise Sensitive Receptors	Negligible adverse	27	34	34	38	
			Minor adverse	0	0	0	0	
			Moderate adverse	0	0	0	0	
			Major adverse	0	0	0	0	
			No Impact	2	1	0	1	
			Negligible beneficial	8	7	8	5	
			Minor beneficial	1	0	2	0	
			Moderate beneficial	3	2	1	1	
			Major beneficial	4	1	0	0	

Table 16.39: Summary of Assessment – Operational Noise in the Short-term (Night-time)

Chapter/Subcategory/ Receptor/Magnitude of Impact				Number of Receptors				Comments
				Option ST2A	Option ST2B	Option ST2C	Option ST2D	
Noise and Vibration	Operation	Dwellings	Negligible adverse	165	197	337	334	Option ST2A results in the fewest potential significant adverse effects (three) and most potential significant beneficial effects (248) in the short-term during night-time, as 1.5km of this proposed route option is in a tunnel as it passes Birnam and consequently noise impacts along this section during operation are largely beneficial. Options ST2C and ST2D result in the most potential significant adverse effects (18 and 10, respectively) and fewest potential significant beneficial effects (20 and 12, respectively) in the short-term during night-time. The difference between predicted potential significant adverse and beneficial effects in the short-term during night-time between the proposed route options is considered to be a differentiator, with Option ST2A the lowest overall adverse effects and Options ST2C and ST2D the highest overall adverse effects.
			Minor adverse	64	93	148	136	
			Moderate adverse	0	0	4	0	
			Major adverse	0	0	0	0	
			No Impact	37	43	31	46	
			Negligible beneficial	138	191	172	192	
			Minor beneficial	130	168	80	70	
			Moderate beneficial	58	52	10	4	
			Major beneficial	190	38	0	0	
		Other Noise Sensitive Receptors	Negligible adverse	15	14	20	19	
			Minor adverse	5	5	6	7	
			Moderate adverse	0	0	0	0	
			Major adverse	0	0	0	0	
			No Impact	5	8	6	8	
			Negligible beneficial	11	10	6	8	
			Minor beneficial	1	5	4	2	
			Moderate beneficial	2	1	2	1	
			Major beneficial	6	2	1	0	

Table 16.40: Summary of Assessment – Operational Noise in the Long-term (Night-time)

Chapter / Subcategory / Receptor / Magnitude of Impact				Number of Receptors				Comments
				Option ST2A	Option ST2B	Option ST2C	Option ST2D	
Noise and Vibration	Operation	Dwellings	Negligible adverse	313	400	568	566	Option ST2A results in the most potential significant beneficial effects (185) in the long-term during night-time, as 1.5km of this proposed route option is in a tunnel as it passes Birnam and consequently noise impacts along this section during operation are largely beneficial. Options ST2C and ST2D result in the fewest potential significant beneficial effects (2 and 0, respectively) in the long-term during night-time. No significant adverse effects are predicted in the long-term during night-time for all proposed route options. The difference between predicted potential significant adverse and beneficial effects in the long-term during night-time between the proposed route options is considered to be a differentiator, with Option ST2A the lowest overall adverse effects and Options ST2C and ST2D the highest overall adverse effects.
			Minor adverse	0	0	4	0	
			Moderate adverse	0	0	0	0	
			Major adverse	0	0	0	0	
			No Impact	25	17	20	18	
			Negligible beneficial	206	286	185	197	
			Minor beneficial	59	45	5	1	
			Moderate beneficial	72	30	0	0	
			Major beneficial	107	4	0	0	
		Other Noise Sensitive Receptors	Negligible adverse	27	34	34	38	
			Minor adverse	0	0	0	0	
			Moderate adverse	0	0	0	0	
			Major adverse	0	0	0	0	
			No Impact	2	1	0	1	
			Negligible beneficial	8	7	10	5	
			Minor beneficial	2	1	1	1	
			Moderate beneficial	2	1	0	0	
			Major beneficial	4	1	0	0	

Compliance Against Plans and Policies

16.6.8 DMRB LA 104 (Highways England et al, 2020b) states that environmental assessment, reporting and monitoring shall meet the requirements of the national planning policy for each relevant Overseeing Organisation.

16.6.9 *Appendix A21.1 (Assessment of Policy Compliance)* provides a review of national and local policy documents which are of relevance to this assessment undertaken and reported in this chapter in accordance with DMRB guidance.

16.6.10 National Planning Policy objectives (and accompanying best practice guidance) of relevance to this assessment are provided in National Planning Framework 3 (Scottish Government, 2014a), Scottish Planning Policy (SPP) (Scottish Government, 2014b; Revised 2020) themes Placemaking and Valuing the Natural Environment as well as PAN 1/2011 (Planning and Noise) (Scottish Government, 2011). In addition, local policies of relevance include Perth and Kinross Local Development Plan 2 (PKC LDP2) Policy 56 (Noise Pollution) (PKC 2019).

16.6.11 A full policy compliance assessment can be found in Table 8 of *Appendix A21.1 (Assessment of Policy Compliance)*. It is assessed that a more detailed assessment of the Preferred Route Option, including a noise mitigation strategy and appropriate mitigation measures would be developed at DMRB Stage 3 in order to reduce adverse noise impacts at receptors, and this would inform a further assessment against national and local policy. At this stage compliance/conflict cannot be established.

Community Objectives

16.6.12 The community objectives (refer to Volume 1, Part 3 – Environmental Assessment (Chapter 7: Overview of Environmental Assessment, Table 7.2)) have been considered throughout DMRB Stage 2. *Appendix A7.1: Mapping of Community Objectives Against DMRB Stage 2 Route Options* sets out which DMRB Stage 2 assessment environmental topics are relevant to each of the Objectives.

16.6.13 *Appendix A7.1: Mapping of Community Objectives Against DMRB Stage 2 Route Options* confirms that community objective 1 is relevant to the assessment of noise and vibration. Professional judgement has been used to consider how the proposed route options contribute to these objectives for the operation phase, as summarised in Table 16.41.

16.6.14 The contribution of the operation phase of each of the proposed route options to the relevant community objectives was categorised according to the following key.

Contributes to all/most of the community objective

Contributes to part of the community objective

Contributes to little/none of the community objective

Table 16.41: Contribution to Community Objectives During Operation for this Environmental Topic

Relevant Community Objective		Option ST2A	Option ST2B	Option ST2C	Option ST2D
1	Reduce current levels of noise and pollution in the villages of Dunkeld, Birnam and Inver to protect human health and well-being of residents and visitors and to enable them to peacefully enjoy their properties and amenity spaces.				

16.6.15 During operation, all proposed route options would result in both increases and decreases in noise, with Options ST2A and ST2B predicted to result in the greatest number of significant decreases in noise and the least number of significant increases in noise. Option ST2C and Option ST2D are predicted to result in the least number of significant decreases in noise and the greatest number of significant increases in noise. As such, it is considered that all proposed route options would contribute in part towards community objective 1, however, Option ST2A and Option ST2B contribute the most towards the community objective in terms of noise.

Comparative Assessment

16.6.16 It is considered that Option ST2A would have the highest overall construction noise and vibration effect due to the necessity for bored piles and the longest construction period (4.5 to 5 years). Option ST2B is expected to have intermediate effect due to the second longest construction period (4 to 4.5 years). Option ST2C and Option ST2D are considered to have the lowest overall effect.

Table 16.42: Comparative Assessment – Construction Noise and Vibration

Route Option	Lowest Overall Effect	Intermediate Overall Effect	Highest Overall Effect
Option ST2A			✓
Option ST2B		✓	
Option ST2C	✓		
Option ST2D	✓		

16.6.17 It is considered that Option ST2A would have the lowest overall operational noise effect due to the presence of the 1.5km cut and cover tunnel. Option ST2B is expected to have intermediate effect due to the lowered carriageway and 150m underpass. Option ST2C and Option ST2D are considered to have the highest overall effect.

Table 16.43: Comparative Assessment – Operational Noise

Route Option	Lowest Overall Effect	Intermediate Overall Effect	Highest Overall Effect
Option ST2A	✓		
Option ST2B		✓	
Option ST2C			✓
Option ST2D			✓

16.7 Scope of Stage 3 Assessment

16.7.1 It is proposed that the Stage 3 assessment for Noise and Vibration would be undertaken in accordance with the DMRB, in particular with DMRB LA 111. The scope of the noise and vibration assessment of the Preferred Route Option would be similar to that undertaken at DMRB Stage 2, with a number of additional steps and comparisons made.

16.7.2 An assessment of the potential impacts and effects arising from construction of the Preferred Route Option would be undertaken, including interrogation of the measured baseline noise data to derive anticipated noise limits using BS 5228-1.

16.7.3 Further consideration would also be given to construction vibration, making reference to the guidance and criteria in BS 5228-2 relating to human response to vibration in buildings and damage levels from ground-borne vibration in buildings.

16.7.4 For the operational assessment, the Preferred Route Option would be modelled using computer-based modelling software and appropriate noise mitigation measures identified where required.

16.7.5 A key focus for the DMRB Stage 3 assessment would be to develop a noise mitigation strategy and identify appropriate noise mitigation measures to reduce potential adverse noise impacts and resulting significant effects at NSRs.

16.8 References

Legislation

Control of Noise (Codes of Practice for Construction and Open Sites) (Scotland) Order 2002.

Control of Pollution Act 1975.

Environmental Noise (Scotland) Regulations 2006.

Noise Insulation (Scotland) Regulations 1975.

Reports and Documents

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Highways England, Transport Scotland, Welsh Government, Department for Infrastructure (2020a). Design Manual for Roads and Bridges (DMRB): Sustainability & Environment. LA 111 'Noise and vibration' (Revision 2).

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Perth & Kinross Council (2019). Adopted Perth & Kinross Council Local Development Plan 2.

Scottish Government (2011a). PAN 1/2011, Planning Advice Note – Planning and Noise.

Scottish Government (2011b). TAN, Technical Advice Note – Assessment of Noise.

Scottish Government (2014a). National Planning Framework 3 (NPF3).

Scottish Government (2014b; Revised 2020), Scottish Planning Policy (SPP).

Transport Scotland (2018). Transportation Noise Action Plan.

17. Population – Accessibility

17.1 Introduction

17.1.1 This chapter presents the Design Manual for Roads and Bridges (DMRB) Stage 2 assessment of potential impacts and effects on the journeys made by walkers, cyclists and horse-riders (WCH)[1]. This includes consideration of footpaths, cycle routes, and informal access to land.

17.1.2 A visual assessment which considers the potential impacts of changes to views from the road for vehicle travellers is provided in Volume 1, Part 3 – Environmental Assessment (Chapter 13: Visual).

Legislative and Policy Background

17.1.3 This section provides a summary of legislation and planning policies considered in the preparation of this chapter. Further information on national, regional and local legislation and planning policies is presented in Volume 1, Part 3 – Environmental Assessment (Chapter 21: Policies and Plans) and Volume 1 – Part 6 – Appendices (*Appendix A21.1: Assessment of Policy Compliance*).

Legislation

Land Reform Act (Scotland) Act 2003

17.1.4 The Land Reform (Scotland) Act 2003 Part 1 (the Act) came into effect in February 2005 and established statutory rights of responsible access on and over most land and inland water in Scotland. The legislation offers a general framework of responsible conduct for both those exercising rights of access and for landowners.

17.1.5 Under the Act, local authorities were granted new powers and duties to uphold and facilitate responsible access rights. There is a duty on local authorities to prepare a plan for a path network and to keep a list of 'core paths'. Sections 13 and 19 of the Act state:

> *'It is the duty of the local authority to assert, protect and keep open and free from obstruction or encroachment any route, waterway or other means by which access rights may reasonably be exercised'; and*
>
> *'The local authority may do anything which they consider appropriate for the purposes of maintaining a core path and keeping a core path free from obstruction or encroachment.'*

17.1.6 Section 10 of the Act states that it is the duty of NatureScot[2] to prepare and issue a Scottish Outdoor Access Code, setting out guidance in relation to access rights and responsibilities. Furthermore, it is the duty of NatureScot and local authorities to publicise the Code and for NatureScot to promote understanding of it. The Code was approved by the Scottish Parliament in July 2004 and is maintained by the National Access Forum (NAF), set up by NatureScot.

Equality Act 2010

17.1.7 The Equality Act came into force in October 2010, replacing the amended Disability Discrimination Act 2005. The Act introduced a new public sector general equality duty, which requires Scottish public authorities to pay 'due regards' to the need to:

[1] Walkers, cyclists and horse-riders (WCH) were previously referred to as Non-Motorised Users (NMU) under superseded DMRB Volume 11 'Pedestrians, Cyclists, Equestrians and Community Effects'.
[2] SNH were re-branded as NatureScot in 2020.

- eliminate unlawful discrimination, victimisation and harassment;
- advance equality of opportunity; and
- foster good relations.

17.1.8 Transport Scotland's 'Roads for All: Good Practice Guide for Roads' (Transport Scotland, 2013b) outlines the key elements in the process which should be followed when designing a road improvement scheme to ensure the needs of disabled people are integrated into the design.

17.1.9 As described in paragraphs 17.2.37 to 17.2.38, at DMRB Stage 2 the engineering design and detail of the proposed route options is limited, and designs do not specify provisions for WCH. The assessment has therefore been informed by discussions with the design team. Where provision is anticipated to be developed at DMRB Stage 3 this has been taken into account and reported in the assessment. Further detailed work will be undertaken during the DMRB Stage 3 assessment to inform the design of the preferred route option taking into account Transport Scotland's 'Roads for All: Good Practice Guide for Roads' (Transport Scotland, 2013).

Policy

17.1.10 Key policy themes of relevance to this topic include the provision and promotion of access for all road users, including WCH, and the improvement of access and rights of way. Key policies associated with this are TAYplan Policy 2 (Shaping Better Quality Places) (TAYplan, 2017), Perth & Kinross Council (PKC) Local development Plan 2 Policy 1B (Placemaking), Policy 15 (Public Access), Policy 42 (Green Infrastructure), Policy 60 (Transport Standards and Accessibility Requirements) (PKC, 2019), in addition to the provisions of SPP on promoting sustainable economic growth, and promoting rural development.

17.1.11 An assessment of the proposed route options' compliance with national, regional and local planning policy, for example Scotland's National Planning Framework 3 (NPF3) 2014 (Scottish Government, 2014a), is provided in Section 17.6 of this chapter and Appendix A21.1: Assessment of Policy Compliance.

Scottish Planning Policy

17.1.12 The Scottish Government, under Scottish Planning Policy (SPP) (Scottish Government, 2014b; Revised 2020), indicates that the fundamental principle of sustainable development is that it integrates economic, social and environmental objectives. The aim is to achieve the right development in the right place. SPP guides the planning system to promote development that supports the move towards a more economically, socially and environmentally sustainable society.

Regional Policy: TAYplan Strategic Development Plan (SDP) (2017)

17.1.13 TAYplan Policy 2 seeks a consistent integration of transport and land use be applied across projects in the region, including the use of a "design-led" principle.

Local Policy: Perth & Kinross Local Development Plan

17.1.14 Policy 15 (Public Access) sets out to retain existing paths whilst enhancing their amenity. Where this is not possible, alternative access should be provided that is no less attractive, is safe and convenient for public use, and does not damage or disturb species or habitats. Policy 60(B) (Transport Standards and Accessibility Requirements – New Development Proposals) also requires that proposals should be well served by, and easily accessible to, all modes of transport. In particular, the sustainable modes of walking, cycling and public transport should be considered, in addition to cars. The aim of all development should be to reduce travel demand by car, and ensure a realistic choice of access and travel modes is available. Finally, Policy 1 (Placemaking) seeks holistic themes to promote sustainable development, provide services in appropriate locations, and to enhance environmental quality in the Perth and Kinross area

17.2 Approach and Methods

Introduction

17.2.1 The assessment at DMRB Stage 2 is based on guidance contained in DMRB LA 112 'Population and Human Health' (Highways England et al., 2020a) (hereafter referred to as 'DMRB LA 112'). This updated guidance replaced DMRB Volume 11, Section 3, Part 6 (Land); Part 8 (Pedestrians, Cyclists, Equestrians and Community Effects); and Part 9 (Vehicle Travellers), along with DMRB Interim Advice Notes (IAN) 125/09 Supplementary Guidance for Users of DMRB Volume 11 Environmental Assessment (Highways Agency et al., 2009) and IAN 125/15 Environmental Assessment Update (Highways England et al., 2015).

17.2.2 Environmental assessment of population and human health effects reports on the elements of 'land use and accessibility' and 'human health'. Due to the volume and complexity of data covered under 'Population and Human Health' in relation to the A9 dualling corridor, the findings are reported in three linked chapters of this report; this chapter covering 'Population – Accessibility', Volume 1, Part 3 – Environmental Assessment (Chapter 8: Population – Land Use), and Volume 1, Part 3 – Environmental Assessment (Chapter 20: Human Health).

17.2.3 DMRB LA 112 states that the indicative types of data to be collected to form the baseline for accessibility shall comprise the type, location and extent of WCH provision (e.g. public rights of way) within the study area, and the frequency of use of WCH provision within the study area. For the purposes of this assessment, WCH provision is recognised as any defined route within the local path network that can be used by the public to provide access to communities, outdoor areas or links to other paths.

17.2.4 Paths used by WCH are important because they can provide access to local countryside and more remote areas on foot, bike or horse; opportunities for long-distance travelling; safe, non-motorised access to shops, places of business and schools; sports facilities; and opportunities to integrate access and land management.

17.2.5 The use of paths can help to improve health, reduce social exclusion and, unlike other modes of transport, generally has fewer associated costs (e.g. fuel and travel tickets). A good path network can also inspire visitors to enjoy the outdoors and to visit places of landscape, historical, cultural and natural interest. This can encourage financial expenditure and support the local economy.

17.2.6 Taking cognisance of NatureScot's guidance on Environmental Impact Assessment (EIA) (SNH, 2018), the baseline description in Table 17.3 includes whether the WCH paths provide direct access to outdoor areas. The outdoor access areas considered in line with NatureScot guidance are presented in Table 17.1.

Table 17.1: Outdoor Access Areas Considered

Area Based Facilities	National, Regional and Country parks
	Areas subject to a S.49A Management Agreements including public access
	National Nature Reserves and Local Nature Reserves
	Munros and other popular hills, and other types of recreational attraction
	Local open space and green infrastructure
	Places that are used or promoted for more specialised recreational activities such as climbing or mountain biking
Linear Access Facilities	Core paths and wider networks available through access rights
	Long distance routes, regional routes, National Cycle Network
	Any other public rights of way that are not identified as core paths or local paths
	Rivers and canals

Study Area

17.2.7 The study area was defined as up to 500m from the proposed route options as shown on Figure 17.1. However, assessment of impacts in some instances extended beyond this, to allow for consideration of potential effects on the ability for WCH to access outdoor locations in the wider area. WCH paths within the study area fall within the local authority boundary of PKC.

Baseline Conditions

Desk-based Assessment

17.2.8 The desk-based study included a review of digital Ordnance Survey (OS) maps (provided by Transport Scotland in 2018), PKC Core Paths Plan (PKC, 2017) and a web-based search to identify existing paths including core paths, public rights of way and local paths, as well as outdoor areas. The leaflets 'Countryside Trails – Dunkeld', 'Explore Dunkeld Path Network' and 'Tay Forest Park – Tall Trees & Big Views Information' were used to identify promoted walking routes that pass through the study area and provide access to outdoor areas (Atholl Estates Website, accessed 2021; Dunkeld & Birnam Tourist Association Website, accessed 2021; Forestry and Land Scotland website, accessed 2021). In addition, aerial photography provided by Transport Scotland was reviewed (BLOM Survey, 2013).

17.2.9 Figures 17.1 and 17.2 show the paths identified in this assessment with Figure 17.2 focusing on those WCH routes in the vicinity of the proposed Dunkeld Junction options. It should be noted that local paths have generally only been identified within the study area, however, the datasets for core paths, rights of ways and cycle routes extend beyond 500m.

17.2.10 The Land Reform (Scotland) Act 2003 establishes statutory rights of responsible access on and over most land. The outdoor areas identified in paragraph 17.3.14 therefore include areas of privately owned land that may be used informally by the community in addition to the Community Land identified in Volume 1, Part 3 – Environmental Assessment (Chapter 8: Population – Land Use).

17.2.11 The baseline assessment was also informed by a review of the following documents:

- Accessibility Audit – Objectives Setting & Context Report. A9 Dualling Preliminary Engineering Services (Jacobs, 2014a); and
- Cycle Audit – Objectives Setting & Context Report. A9 Dualling Preliminary Engineering Services (Jacobs, 2014b).

17.2.12 The A9 Route Improvement Strategy Dualling of Birnam to Tay Crossing, Stage 2 Options Assessment Report (Transport Scotland, 2011) was also reviewed as part of the baseline assessment.

17.2.13 The type of user, and where possible the usage levels, have been determined from information provided through desk-based assessment and the consultation process and is noted in Table 17.2 which describes WCH provision within the study area.

Site Surveys

17.2.14 To verify the baseline data collected through desk-based assessment, a visual inspection of WCH routes was undertaken within the study area on 10 and 11 March 2015 and 5 and 6 July 2016. The DMRB Stage 2 assessment process for this project has extended beyond the typical expected timeframe, which has led to a longer period than normal elapsing since the baseline was established. This is primarily due to additional community engagement undertaken through the Co-Creative Process, which is explained in Volume 1, Part 3 – Environmental Assessment (Chapter 6: Summary of Previous Environmental Assessment). For the purposes of a DMRB Stage 2 assessment the available baseline data are considered appropriate, however, further verification would be undertaken as part of the DMRB Stage 3 assessment.

Consultation

17.2.15 A summary of the consultation is reported in Volume 1, Part 3 – Environmental Assessment (Chapter 7: Overview of Environmental Assessment, Section 7.6 (Consultation)). Key consultations that have informed this assessment are summarised in the following paragraphs.

17.2.16 Consultation was undertaken with various access, cycling, equestrian and walking groups to inform the baseline assessment and confirm the path network described and assessed is accurate. The consultees provided information regarding the locations and usage of paths and key crossing points. Rights of way data received from ScotWays were digitised by Jacobs at a larger scale to enable the paths to be accurately displayed on the figures accompanying this assessment. ScotWays were issued the revised dataset and confirmed that the data were appropriate for the purpose of this assessment.

17.2.17 Consultation was undertaken with various access, cycling, equestrian and walking groups to inform the baseline assessment. The consultees provided information regarding the locations and usage of paths and key crossing points. Consultation with various stakeholders also took place in two WCH forums (in May 2015, and May 2016) and during the A9 Co-Creative process. Information gained from stakeholders during these discussions was used to inform the baseline in this assessment (Transport Scotland - Capital Value and Risk, 2015; 2016). Further information on the consultation process is provided in Volume 1, Part 3 – Environmental Assessment (Chapter 7: Overview of Environmental Assessment). The consultation process informed the identification of potential conflict areas between WCH and the proposed route options assessed in the DMRB Stage 2 Report. This information would also be taken into account during the DMRB Stage 3 assessment, where mitigation measures would be further developed and incorporated into the design of the Preferred Route Option. Additional consultation would also be undertaken at DMRB Stage 3 to inform the assessment process and the development of mitigation.

Impact Assessment

17.2.18 In accordance with DMRB LA 112, the assessment of impacts on WCH focuses on potential impacts on/changes to journey length. As noted in paragraph 17.2.3, this assessment has also taken consideration of WCH ability to access the outdoors.

17.2.19 For the purposes of the accessibility assessment reported in this chapter, and to inform a more complete assessment of impacts on WCH as a result of the proposed scheme, changes to journey amenity have also been considered as described in paragraphs 17.2.28 to 17.2.30.

Importance/Sensitivity

17.2.20 Table 17.2 outlines the sensitivity criteria applied in this assessment. Criteria from DMRB LA 112 has been supplemented with additional parameters related to the level of formal recognition of a pathway based on professional judgement. Designated paths, such as core paths, have statutory protection under the Land Reform (Scotland) Act 2003.The Act also confirms that *'it is the duty of the local authority to assert, protect and keep open and free from obstruction or encroachment any route, waterway or other means by which access rights may reasonably be exercised'.* Therefore, in acknowledgement of the statutory duties placed on local authorities by the Land Reform (Scotland) Act 2003 (outlined in paragraph 17.1.5) sensitivity was determined primarily based on importance (the level of formal recognition of a pathway) rather than on frequency of use.

17.2.21 Where a path could be attributed to more than one category (e.g. a core path may also be a claimed right of way) the highest sensitivity rating was applied. Vulnerable users include children, elderly persons, and those affected by a disability.

Table 17.2: Environmental Sensitivity Descriptions for WCH Routes

Sensitivity	Parameters
Very High	▪ National trails, core paths and rights of way likely to be used for both community and recreation that record frequent (daily) use. Little/no potential for substitution. ▪ Routes regularly used by vulnerable travellers such as the elderly, school children and people with disabilities. ▪ Routes for WCH crossing roads at grade with >16,000 vehicles per day.
High	▪ Regional trails, core paths and rights of way (e.g. promoted circular walks) likely to be used for recreation and to a lesser extent commuting, that record frequent (daily) use and have limited potential for substitution. ▪ Routes for WCH crossing roads at grade with >8,000 – 16,000 vehicles per day.
Medium	▪ Public rights of way and other routes close to communities which are used for recreational purposes (e.g. dog walking), but for which alternative routes can be taken. These routes are likely to link to a wider network of routes to provide options for longer, recreational journeys. ▪ Routes for WCH crossing roads at grade with >4,000 – 8,000 vehicles per day.
Low	▪ Routes which have fallen into disuse through past severance or which are scarcely used because they do not currently offer a meaningful route for either utility or recreational purposes. ▪ Routes for WCH crossing roads at grade with <4,000 vehicles per day. ▪ Local routes/other paths outwith the above categories.

17.2.22 Community facilities used by vulnerable groups, for example schools and medical practices, where applicable, have been identified in Volume 1, Part 3 – Environmental Assessment (Chapter 8: Population – Land Use) and are shown on Figure 13.1. The potential impacts on human health due to a change in access to community facilities are outlined in Volume 1, Part 3 – Environmental Assessment (Chapter 20: Population – Human Health). Section 17.3 (Baseline Conditions) describes the paths in the study area and provides a sensitivity rating in line with the parameters in Table 17.2. As outlined in Table 17.2, the sensitivity rating of paths takes into consideration use by vulnerable groups.

17.2.23 WCH paths within the study area fall within the local authority boundary of PKC.

Impact Magnitude

17.2.24 For the purposes of this assessment, the magnitude of impact is considered to be a function of a change in journey length (increase, decrease or no change) or a change in amenity value (increase, decrease or no change). These aspects are discussed in further detail in paragraphs 17.2.25 to 17.2.29.

Journey Length

17.2.25 A change in journey length is assumed where there would be a direct impact on a path through a change in the ability of WCH to use the path in its current form (e.g. due to path severance or realignment).

17.2.26 The proposed route options (and any impacts to WCH) are in the preliminary design stages and embedded WCH route diversions or realignments have not been determined at this stage. Therefore it is not possible to apply the magnitude criteria in DMRB LA 112 Table 3.12 with regards to impacts on WCH as these relate to specific changes in journey length (e.g. Major magnitude of impact relates to a journey length change of >500m, Moderate magnitude of impact relates to a journey length change >250m - 500m increase (adverse) or decrease (beneficial) in WCH journey length).

17.2.27 The number and type of paths potentially impacted by each proposed route option is therefore reported with magnitude of changes to journey lengths described qualitatively, i.e. 'increase', 'decrease' or 'no change'.

Amenity Value

17.2.28 The assessment of potential impacts on amenity for WCH was undertaken with cognisance of previous DMRB guidance, Volume 11 Section 3 Part 8 'Pedestrians, Cyclists, Equestrians and Community Effects'. A bespoke approach to the amenity assessment has been developed based on professional judgement and developed through DMRB Stage 2 assessments of trunk road schemes in Scotland.

17.2.29 Amenity value is defined in DMRB guidance, Volume 11 Section 3 Part 8 'Pedestrians, Cyclists, Equestrians and Community Effects' as the '*relative pleasantness of a journey*' and includes consideration of any change in the safety of paths and/or exposure to noise, dirt and air pollution, as well as the visual impact associated with the proposed route options. The assessment findings for these parameters as reported in the respective chapters of Volume 1, Part 3 – Environmental Assessment (Chapter 13: Visual; Chapter 15: Air Quality; and Chapter 16: Noise and Vibration) of this DMRB Stage 2 assessment were reviewed to inform the identification of potential changes to amenity value. For assessment of the potential levels of traffic encountered by cyclists on roads, reference has also been made to findings within Volume 1, Part 4 – Traffic and Economic Assessment (Chapter 21: Effects of Route Options).

17.2.30 For the purposes of this assessment, adverse impacts on amenity are expected to occur where the proposed route option is within closer proximity to a path than the existing A9 or interferes with the route of the path. Magnitude of changes to amenity value are described qualitatively, i.e. 'increase', 'decrease', or 'no change'.

Potential Impacts and effects

17.2.31 As described in paragraph 17.2.26, at DMRB Stage 2 the magnitude criteria set out in DMRB LA 112 Table 3.12 have not been applied. Consequently, it is not possible to apply the significance criteria in accordance with the matrix set out in Table 3.8.1 of DMRB LA 104 'Environmental assessment and monitoring' (Highways England et al., 2020b; hereafter referred to as 'DMRB LA 104'). Therefore, for the purpose of this DMRB Stage 2 assessment, potential effects are considered to be either significant or not significant and may be beneficial or adverse in nature. Potential effects were determined qualitatively using professional judgment and took into account the degree of change to journey length and amenity. For the purpose of this assessment, impacts and effects are considered adverse unless otherwise stated.

17.2.32 Potential impacts and effects on WCH paths were also considered at crossing points for WCH. There are two types of crossing considered; where an existing path crosses the A9 via an existing overbridge or underpass or locations where the existing A9 can be currently crossed at-grade. In addition, the assessment considers new 'conflict areas' where paths and cycle routes located adjacent to the existing A9 and the proposed route options interact. For example, by decreasing the separation distance between the paths and the A9; or where side roads cross paths/cycle routes and where there are changes in local traffic flows on roads that are used by WCH.

Vehicle Travellers (View from the Road)

17.2.33 The 'View from the Road' assessment was undertaken in accordance with the guidance provided in DMRB Volume 11, Section 3, Part 9: Vehicle Travellers (The Highways Agency et. al., 1993b). The assessment takes into account the types of scenery or landscape character, through which travellers will pass through, the extent to which travellers would be able to view the scene, the quality of the landscape and features of particular interest or prominence in the view. The 'View from the Road' assessment is reported in Volume 1, Part 3 – Environmental Assessment (Chapter 13: Visual).

Community Objectives

17.2.34 At an early stage in the A9 Co-Creative Process, the Birnam to Ballinluig A9 Community Group generated community objectives. The seven community objectives are presented in Volume 1, Part 3 – Environmental Assessment (Chapter 7: Overview of Environmental Assessment) and cover a wide range of topics but focus predominantly on environmental issues.

17.2.35 The community objectives have been taken into consideration throughout the DMRB Stage 2 assessment process, and a mapping exercise was conducted to indicate how the proposed route options could contribute to the relevant objectives. Details of how each environmental topic contributes towards achieving the community objectives is presented in *Appendix A7.1: Mapping of Community Objectives Against DMRB Stage 2 Route Options* and a summary for this chapter is presented in Section 17.6 (Summary of Route Options Assessment).

Limitations to Assessment

17.2.36 The assessment considers potential loss and severance of paths as a result of the proposed route options, however, at this stage the engineering design and detail of the proposed route options is limited. This is particularly evident at crossing points where the detail of WCH provision is still to be developed in detail, the assessment has therefore been informed by discussions with the design team and where further provision is anticipated to be developed at DMRB Stage 3 this has been taken into account and reported in the assessment. The above limitations are typical of a DMRB Stage 2 assessment, and the assessment reported in this chapter is considered robust, of an appropriate level of detail, and in line with the DMRB guidance. Further detailed work would be undertaken during the DMRB Stage 3 assessment to inform the design of the Preferred Route Option.

17.3 Baseline Conditions

Introduction

17.3.1 The baseline conditions for the study area are described below, listed in Table 17.2 and shown on Figures 17.1 and 17.2.

Core Paths

17.3.2 As stated in paragraph 17.1.5, local authorities have a duty to prepare a Core Paths Plan under the Land Reform (Scotland) Act 2003. The local authority responsible for access within the study area is PKC. The PKC Core Paths Plan was adopted on 25 January 2012 (revised in 2017) and aims to satisfy the basic needs of local people and visitors for general access and recreation, and provide links to the wider path network throughout (PKC, 2017). The core path network is meant to cater for all types of users including walkers, cyclists, horse riders, canoeists and people with disabilities, and is a key part of outdoor access provision. The majority of the core paths are situated around communities and are valued by both locals and tourists.

17.3.3 Core paths may include the following: public rights of way, footpaths, tracks, cycle tracks, paths which are, or may be, covered by path agreements or path orders under the Land Reform (Scotland) Act 2003 (Sections 20 and 21), waterways, or other means by which persons may cross land. In establishing the Core Paths Plan, consideration of likely usage and desirability of paths is balanced with landowner interests.

17.3.4 There are 33 paths designated as core paths within the study area, as shown on Figure 17.1. Photograph 17.1 shows a core path (Path 35) crossing the River Braan.

Photograph 17.1: Core path across River Braan (Path 35)

Public Rights of Way

17.3.5 A public right of way is a defined route which has been used by the general public for at least 20 years and which links two public places (usually public roads). Public rights of way vary from long hill routes (often historical drove or kirk roads) to local routes or as short cuts to shops, schools and other local amenities.

17.3.6 ScotWays maintains the National Catalogue of Rights of Way (CROW), in partnership with NatureScot. In addition, many local authorities also have their own records. Access along public rights of way is protected by the Countryside (Scotland) Act 1967, Section 46, requiring the local authority to *'assert, protect and keep open and free from obstruction or encroachment any public rights of way'*. Diversions can be considered if the proposed diversion is deemed suitable by the planning authority. Photograph 17.2 shows a right of way (also a core path) which forms part of Birnam Riverside Path (Path 24).

17.3.7 There are eight paths designated as public rights of way within the study area, as shown on Figure 17.1.

Photograph 17.2: Core path and right of way forming part of Birnam Riverside Path (Path 24)

Local Paths

17.3.8 Unlike core paths and public rights of way, local paths hold no statutory designation. Local paths can either be pavements adjacent to roads or off-road paths.

17.3.9 There are 20 paths that have been identified as local paths within the study area, as shown on Figure 17.1.

National and Regional Cycle Routes

17.3.10 The National Cycle Network is a UK network of cycle routes (national and regional) and was created by Sustrans. The routes are a combination of pedestrian routes, disused railways, minor roads, canal towpaths and traffic calmed routes. In some cases, National Cycle Routes (NCRs) and/or Regional Cycle Routes (RCRs) are also designated as core paths or public rights of way. National Cycle Routes form part of the National Long Distance Cycling and Walking Network, a National Development in the Scottish Government's Third National Planning Framework (Scottish Government, 2014a).

17.3.11 There is one National Cycle Route (NCR77) that passes through the study area, as shown on Figure 17.1 and in Photograph 17.3. Paths NCR77 (south), NCR77 (Little Dunkeld), NCR77 (north), 22, 28, 34, 38, 43 and 48 are all part of this route. There is also one Regional Cycle Route (RCR83) that passes through the study area, beginning north of Dunkeld and running parallel alongside the existing A9 towards Ballinluig as shown on Figure 17.1.

Photograph 17.3: National Cycle Route 77 between B867 and Dunkeld & Birnam Station

17.3.12 The area around Dunkeld is well-regarded for mountain biking, with many trails identified on Trailforks.com, a crowd-sourced database providing maps and information on trails for multiple activities. The routes use a variety of existing formal and informal paths within and around the study area, including some of the paths identified in Table 17.2. There is a high concentration of routes around Craigvinean Plantation by The Hermitage, Birnam Hill, and Atholl Wood.

Existing A9 WCH Crossing Points

17.3.13 There are six existing A9 WCH crossing points (CP) listed as follows (Table 17.2 provides further details of paths described and locations of CPs and paths are shown on Figure 17.1):

- **CP01** – WCH cross the existing A9 via an at-grade crossing using Path 7 (Photograph 17.4).
- **CP02** – WCH cross the existing A9 via an at-grade crossing using Path 23 (Photograph 17.5).
- **CP03** – WCH cross underneath the existing A9 via the Birnam Glen Underbridge using Path 28/NCR77.

- **CP04** – WCH cross underneath the existing A9 via the River Braan Underbridge using Path 35 on both the east and west sides of the River Braan and utilise the existing NMU bridge to cross the river (Photograph 17.6).
- **CP05** – WCH cross underneath the existing A9 via the existing bridge over the River Tay on the south bank of the river using Path 35.
- **CP06** – WCH cross underneath the existing A9 via the existing bridge over the River Tay on the north bank of the river using Path 38/NCR77.

Photograph 17.4: At-grade crossing point CP01, Path 7
(Image from Google Street View captured 2017 © 2018 Google)

Photograph 17.5: At-grade crossing point CP02, Path 23
(Image from Google Street View captured 2017 © 2018 Google)

Photograph 17.6: Grade separated crossing point CP04, Path 35 (view of crossing on east bank of River Braan)

Access to Outdoor Areas

17.3.14 Outdoor areas comprise local open space and green space that are used by the public for recreational purposes. For further details of community land, reference should be made to Volume 1, Part 3 – Environmental Assessment (Chapter 8: Population – Land Use). The key outdoor areas considered within this assessment are listed below:

- Atholl Wood (Figure 17.1e);
- Birnam Hill (Figure 17.1b);
- Birnam Wood (Figure 17.1a);
- Byres Wood (Figure 17.1a);
- Dalpowie Plantation (Figure 17.1a);
- Inchewan Burn (Figure 17.1b-c);
- The Hermitage (Figure 17.1d);
- Polney Loch (Figure 17.1c);
- Ring Wood (Figure 17.1a-b);
- River Braan (Figure 17.1c);
- River Tay (Figure 17.1a-e);
- Rochanroy Wood (Figure 17.1a);
- Rohallion Loch (Figure 17.1a);
- Tay Forest Park - Craigvinean Plantation (Figure 17.1d-e); and
- Tay Forest Park - Ladywell Plantation (Figure 17.1c).

17.3.15 The WCH paths that provide access to these outdoor areas, as well as promoted walking/cycling routes are listed in Table 17.3.

Table 17.3: Path Network within Study Area

Path Reference (Figure Reference)	Designation (including Local Authority Core Path Reference)	Main Users*	Description	Direct Access to Outdoors Link**	Sensitivity
NCR77 (south) Figure 17.1a	National Cycle Route NCR77	Cyclists	NCR77 (south) is on road along the B867 in the south of the study area. The route connects into Paths 8, 16, 19, 20 and Path 22/NCR77.	Provides access to Birnam Wood, Rohallion Loch and Ring Wood	Very High
NCR77 (Little Dunkeld) Figure 17.1b-c	National Cycle Route NCR77	Cyclists	NCR77 (Little Dunkeld) is on-road along Perth Road through Little Dunkeld between Birnam Glen and the A923. Connects into Paths 25, 28/NCR77 and 34/NCR77.	No direct access provided to the outdoor areas listed in paragraph 17.3.13.	Very High
NCR77 (north) Figure 17.1e	National Cycle Route NCR77	Cyclists	NCR77 (north) is on road along the B898. Connects into Paths 48/NCR77, 35 and 45.	Provides access to Tay Forest Park - Craigvinean Plantation	Very High
1 Figure 17.1a	Local Path (non-designated)	Pedestrians	Path 1 is an access track through Byres Wood. Connects into Path 2.	Provides access to Byres Wood.	Low
2 Figure 17.1a	Local Path (non-designated)	Pedestrians	Path 2 is an access track through Byres Wood. Connects into Path 1.	Provides access to Byres Wood.	Low
3 Figure 17.1a	Core Path SPIT/108	Pedestrians	Path 3 connects into Paths 4 and 7 in the south of the study area.	No direct access to outdoor areas.	High
4 Figure 17.1a	Core Path SPIT/109	Pedestrians	Path 4 is a riverside path connecting into Paths 3 and 7.	Provides access to the River Tay.	High
5 Figure 17.1a	Core Path SPIT/113	Pedestrians	Path 5 provides access from Bee Cottage to Byres of Murthly. Connects into Paths 6 and 8.	Provides access to Birnam and Byres Wood.	High
6 Figure 17.1a	Local Path (non-designated)	Pedestrians	Path 6 is an access track through Byres Wood. Connects into Paths 5 and 8.	Provides access to Byres Woods.	Low
7 Figure 17.1a	Local Path (non-designated)	Pedestrians	Path 7 is an access track located parallel to the existing A9. Provides local access to an at-grade crossing point of the A9 (CP01) and connects into Paths 3 and 4. This path has direct access to/from the existing A9.	Provides access to the Dalpowie Plantation.	Medium

Path Reference (Figure Reference)	Designation (including Local Authority Core Path Reference)	Main Users*	Description	Direct Access to Outdoors Link**	Sensitivity
8 Figure 17.1a	Core Path SPIT/105	Pedestrians	Path 8 provides a link to Paths 5, 6, 9, 10, 12 and 13 and NCR77 (south).	Provides access to Birnam Wood.	High
9 Figure 17.1a	Core Path SPIT/114	Pedestrians	Path 9 provides access from Rohallion path to Birnam Wood path over Court Hill. Provides a connection to Paths 8, 10 and 12.	Provides access to Birnam Wood and Rochallion Loch.	High
10 Figure 17.1a	Local Path (non-designated)	Pedestrians	Path 10 is an access track through Birnam Wood. Connects into Path 8.	Provides access to Birnam Wood.	Low
11 Figure 17.1b	Right of Way TP104	Pedestrians	Path 11 provides access through the village of Birnam to the River Tay.	Provides access to the River Tay.	Very High
12 Figure 17.1a	Local Path (non-designated)	Pedestrians	Path 12 is an access track through Birnam Wood. Connects into Path 8.	Provides access to the Birnam Wood.	Medium
13 Figure 17.1a	Core Path DUNK/102	Pedestrians	Path 13 is the Birnam Wood northern path, providing links to Path 8, 14 and 16.	Provides access to Birnam Wood and Rochanroy Wood.	High
14 Figure 17.1a	Local Path (non-designated)	Pedestrians	Path 14 is an access track through Birnam Wood. Connects into Path 13.	Provides access to Birnam Wood and Rochanroy Wood.	Medium
15 Figure 17.1a	Local Path (non-designated)	Pedestrians	Path 15 is an access track through the Dalpowie Plantation.	Provides access to the Dalpowie Plantation and the River Tay.	Low
16 Figure 17.1a-b	Local Path (non-designated)	Pedestrians	Path 16 is an access track through Rochanroy Wood. Connects into Paths NCR77 (south) and 13.	Provides access to the Rochanroy Wood.	Medium
17 Figure 17.1a-b	Local Path (non-designated)	Pedestrians	Path 17 is an access track through Rochanroy Wood. Connects into Path 18.	Provides access to Rochanroy Wood.	Medium
18 Figure 17.1a-b	Core Path DUNK/14	Pedestrians Cyclists	Path 18 forms part of the 'Birnam Hill Path'. Connects into Paths 17 and 20.	Provides access to Rochanroy Wood. Part of the 'Birnam Hill Path' walking route.	High
19 Figure 17.1b	Local Path (non-designated)	Pedestrians	Path 19 is an access track through Ring Wood connecting into Paths NCR77 (south) and 20.	Provides access to Ring Wood.	Low

Path Reference (Figure Reference)	Designation (including Local Authority Core Path Reference)	Main Users*	Description	Direct Access to Outdoors Link**	Sensitivity
20 Figure 17.1b	Core Path DUNK/69	Pedestrians Cyclists	Path 20 forms part of the Birnam Hill Path. Provides access to the Birnam Quarry car park to the railway underpass south of Craigbeithe. Connects into Paths NCR77 (south),18, 19 and 23.	Provides access to Birnam Wood. Part of the 'Birnam Hill Path' walking route.	High
21 Figure 17.1b	Local Path (non-designated)	Pedestrians	Path 21 is an access track connecting into Path 24.	Provides access to the River Tay.	Low
22/NCR77 Figure 17.1b-c	Core Path DUNK/142 National Cycle Route NCR77	Pedestrians Cyclists	Path 22/NCR77 is a footpath/cycleway, providing access from Dunkeld & Birnam Station to B867 near Birnam Quarry. Connects into NCR77 (south) and Paths 23 and 28/NCR77. This path has direct access to/from the existing A9.	No direct access to the outdoors provided.	Very High
23 Figure 17.1b	Core Path DUNK/57 Right of Way 32/10	Pedestrians Cyclists Equestrians	Path 23 provides access from Birnam Glen to Perth Road at Sewage Works via Craigbeithe railway underpass and across the A9. Path 23 crosses the existing A9 via an at-grade crossing at CP02. CP02 is also a known crossing point for equestrians. Connects into Paths 20, 22/NCR77, 24, 25 and 30. This path has direct access to/from the existing A9.	Provides access Birnam Hill. Part of the 'Birnam Hill Path' walking route.	High
24 Figure 17.1b-c	Core Path DUNK/10 Right of Way TP102	Pedestrians	Path 24 forms part of the Birnam Riverside Path. Provides access from the River Braan at the Bowling Green to Perth Road at Sewage Works via Birnam Oak. Connects into Paths 21, 23, 25, 26, 27, 33, 34/NCR77 and 35.	Provides access to the River Tay and the River Braan. Part of the 'Birnam Riverside Path' walking route.	Very High
25 Figure17.1b-c	Core Path DUNK/103	Pedestrians	Path 25 is a footway along Perth Road from Birnam Hotel to the Sewage Works. Forms part of the 'Birnam Riverside Path' circular walking route. Connects into Paths 23, 24, 26, 26a, 28/NCR77 and NCR77 (Little Dunkeld).	No direct access to the outdoors provided. Part of the 'Birnam Riverside Path' walking route.	Very High
26 Figure 17.1b-c	Core Path DUNK/56 Right of Way 32/10	Pedestrians	Path 26 provides access from Birnam Hotel via St Mary's Road to Birnam Riverside Path behind St Mary's Towers. Connects into Paths 24, 25 and 27.	Provides access the River Tay.	Very High

Path Reference (Figure Reference)	Designation (including Local Authority Core Path Reference)	Main Users*	Description	Direct Access to Outdoors Link**	Sensitivity
26a Figure 17.1b-c	Local path (non-designated)	Pedestrians	Path 26a provides access from Perth Road to Birnam Glen along Station Road. Connects into Paths 25 and 28/NCR77NCR77.	Provides access to Inchewan Burn.	Very High
27 Figure 17.1c	Core Path DUNK/55 Right of Way TP105	Pedestrians	Path 27 forms part of the Birnam Riverside Path. Provides access to Birnam Hotel via Oak Road to Riverside path at Birnam Oak. Connects into Paths 24 and 26.	Provides access the River Tay. Part of the 'Birnam Riverside Path' walking route.	Very High
28/NCR77 Figure 17.1b-c	Core Path DUNK/11 Right of Way TP106 National Cycle Route NCR77	Pedestrians Cyclists Equestrians	Path 28/NCR77 forms part of the Birnam Hill Path and Inchewan Path. Provides access from the Perth Road at Birnam Glen to Birnam Hill and King's Seat. Path 28/NCR77 crosses the existing A9 via the Birnam Glen Underbridge at CP03. CP03 is also a known crossing point for equestrians. Connects into Paths 25, 26a, 29, 30, 31a and NCR77 (Little Dunkeld).	Provides access to Inchewan Burn. Part of the 'Inchewan Path' and 'Birnam Hill Path' walking route.	Very High
29 Figure 17.1c	Core Path DUNK/24	Pedestrians	Path 29 forms part of the 'Inchewan Path'. Provides access along Inchewan Burn from Birnam Glen to Glen Garr path, via Balhomish. Connects into Path 28/NCR77.	Provides access to Inchewan Burn. Part of the 'Inchewan Path' walking route.	Very High
30 Figure 17.1b-c	Core Path DUNK/115	Pedestrians	Path 30 forms part of the 'Birnam Hill Path' walking route. Provides a link path at Birnam Bank. Connects into Paths 23, 28/NCR77 and 30.	Provides access to Inchewan Burn. Part of the 'Birnam Hill Path' walking route.	Very High
31 Figure 17.1c	Local Path (non-designated)	Pedestrians Cyclists	Path 31 is an access track through the Tay Forest Park - Ladywell Plantation. Connects into Path 31a	Provides access to the Tay Forest Park - Ladywell Plantation.	High
31a Figure 17.1c	Local Path (non-designated)	Pedestrians	Path 31a is a track through the Tay Forest Park - Ladywell Plantation. Connects into Path 31 and 28/NCR77	Provides access to Inchewan Burn and Tay Forest Park – Ladywell Plantation	High
32 Figure 17.1c	Local Path (non-designated)	Pedestrians	Path 32 is an access track through the Tay Forest Park - Ladywell Plantation.	Provides access to the Tay Forest Park - Ladywell Plantation.	Medium

Path Reference (Figure Reference)	Designation (including Local Authority Core Path Reference)	Main Users*	Description	Direct Access to Outdoors Link**	Sensitivity
33 Figure 17.1c	Core Path DUNK/59	Pedestrians	Path 33 forms part of the 'Fiddlers Path' and 'Birnam Riverside Path'. Provides access to the River Braan at Bowling Green to A923 at Little Dunkeld. Connects into Path 24 and Path 34/NCR77.	Provides access the River Braan. Part of the 'Fiddler's Path' and 'Inver Path' walking routes.	Very High
34/NCR77 Figure 17.1c	Core Path DUNK/144 National Cycle Route NCR77	Pedestrians Cyclists	Path 34/NCR77 is known as the Fiddlers and Loch of the Lowes Paths. Provides access from the A923 footway to Little Dunkeld and then over Dunkeld Bridge to Atholl Park. Connects into Paths 24, 33, 40, 50 and NCR77 (Little Dunkeld).	Provides access to the River Tay Part of the 'Birnam Riverside Path' walking route.	Very High
35 Figure 17.1c-e	Core Path DUNK/23	Pedestrians Cyclists Equestrians	Path 35 forms part of the Fiddlers and Inver Paths. Provides access from the River Braan at Bowling Green to Newton Craig car park. Path 35 passes underneath the existing A9 three times. Two of these are via the River Braan Underbridge at the crossing of the River Braan (CP04) and the other is via the River Tay Underbridge to the south of the River Tay (CP05). Both CP04 and CP05 are known crossing points for equestrians. Connects into Paths 24, 33, 36, 45, 52 and NCR77 (north). This path has direct access to the existing A9.	Provides access to the River Tay and the River Braan. Part of the 'Inver Path' and 'Fiddler's Path' walking routes. Provides crossing point of the River Braan.	Very High
36 Figure 17.1c	Core Path DUNK/63	Pedestrians	Path 36 forms part of the Inver Path. Provides access to the Inver road footway east of Inver Bridge. Connects into Paths 35 and 41.	Provides access to the River Braan.	Very High
37 Figure 17.1c-d	Core Path DUNK/60	Pedestrians Cyclists	Path 37 forms part of the Braan Path. Provides access to the Inver car park to Ladywell Plantation, crossing A822 (Old Military Road).	Provides access to Tay Forest Park - Ladywell Plantation. Part of the 'Braan Path' walking route.	High
38/NCR77 Figure 17.1c-e	Core Path DUNK/145 National Cycle Route NCR77	Pedestrians Cyclists	Path 38/NCR77 forms part of the Fiddlers Path. Provides access to the A9 footway/cycleway overbridge at Newton Craig. Crosses underneath the existing A9 at CP06. Connects into Paths 40, 43/NCR77, 48/NCR77 and Path 53.	Provides access to the River Tay. Part of the 'Fiddler's Path' walking route.	Very High

Path Reference (Figure Reference)	Designation (including Local Authority Core Path Reference)	Main Users*	Description	Direct Access to Outdoors Link**	Sensitivity
39 Figure 17.1c	Core Path DUNK/137	Pedestrians Cyclists	Path 39 forms part of the Inver Path. Provides access from Inver Park to River Braan footbridge beside A9 bridge. Connects into Paths 35 and 41.	Provides access to the River Braan. Part of the 'Inver Path' walking route.	Very High
40 Figure 17.1c-d	Core Path DUNK/25	Pedestrians	Path 40 forms part of the Bishops and Fiddlers Paths. Provides access from the A923 at car park via Bishop's Hill to Hilton Hotel driveway. Connects into Paths 34/NCR77, 38/NCR77 and 43/NCR77.	Provides access to the River Tay. Part of the 'Fiddler's Path' walking route.	High
41 Figure 17.1c-d	Core Path DUNK/64	Pedestrians Cyclists Equestrians	Path 41 forms part of the 'Braan Path' and 'Inver Path'. Provides access to the Inver Bridge via Hermitage car park and Ossian's Hall to Old Military Road above The Hermitage. Path 41 is also known to be used by equestrians. Connects into Paths 36, 39 and 44.	Provides access to the River Braan and The Hermitage. Part of the 'Inver Path' and 'Braan Path' walking route.	Very High
42 Figure 17.1c-d	Core Path DUNK/22	Pedestrians Cyclists	Path 42 forms part of the Braan Path. Provides access from Inver car park via Hermitage Bridge to Craigvinean Cottage.	Provides access to the River Braan and The Hermitage. Part of the 'Braan Path' walking route.	High
43/NCR77 Figure 17.1c-d	Core Path DUNK/70 National Cycle Route NCR77	Pedestrians Cyclists	Path 43/NCR77 forms part of the 'Bishops Path'. Provides access to the Hilton Hotel driveway from A923 to 250m east of hotel. Connects into Paths 38/NCR77 and 40.	Provides access to the River Tay. Part of the 'Bishops Path' walking route.	Very High
44 Figure 17.1c-d	Core Path DUNK/15 Right of Way TP94	Pedestrians Cyclists	Path 44 forms part of the 'Braan Path'. Provides access from The Hermitage car park on route of Old Military Road to Rumbling Bridge. Connects into Paths 41 and 45.	Provides access to the River Braan and The Hermitage. Part of the 'Inver Path' walking route.	Very High
RCR83 Figure 17.1d-e	Regional Cycle Route RCR83	Pedestrians Cyclists	Path RCR83 is an on-road route that begins north of Dunkeld and runs parallel alongside the existing A9. Connects into Path 49.	Provides access to Atholl Woods.	Very High
45 Figure 17.1d-e	Core Path DUNK/65	Pedestrians Cyclists	Path 45 forms part of the Inver Path. Provides access to the Old Military Road above The Hermitage to Newton Craig car park. Connects into Path 35, 38/NCR77, 44, 46, 47, 52 and NCR77 (north).	Provides access to Tay Forest Park – Craigvinean Plantation. Part of the 'Inver Path' walking route.	High

Path Reference (Figure Reference)	Designation (including Local Authority Core Path Reference)	Main Users*	Description	Direct Access to Outdoors Link**	Sensitivity
46 Figure 17.1d-e	Core Path DUNK/130	Pedestrians Cyclists	Path 46 is the Craigvinean Forest track, Newton Craig to Dalguise. Connects into Path 45.	Provides access to the Tay Forest Park - Craigvinean Plantation.	High
47 Figure 17.1d	Local Path (non-designated)	Pedestrians Cyclists	Path 47 is a forest track that connects into Path 45. This path has direct access to/from the existing A9.	Provides access to the Tay Forest Park - Craigvinean Plantation.	Low
48/NCR77 Figure 17.1e	Core Path DUNK/100 National Cycle Route NCR77	Pedestrians Cyclists	Path 48/NCR77 forms part of the Bishops & Fiddlers Paths. Provides access from Bishop's Hill to the north of the River Tay. Provides links to Paths 35, 38/NCR77 53, and NCR77 (north). This path has direct access to/from the existing A9.	Provides access to the River Tay. Part of the 'Fiddler's Path' walking route.	Very High
49 Figure 17.1d-e	Core Path DUNK/26	Pedestrians Cyclists	Path 49 forms part of the Atholl Wood Path. Connects into Paths 51 and RCR83.	Provides access to Atholl Wood.	High
50 Figure 17.1c	Right of Way TP101	Pedestrians	Path 50 provides access along the River Tay to Path 34/NCR77.	Provides access to the River Tay.	Very High
51 Figure 17.1e	Local path (un-designated)	Pedestrians	Path 51 is part of the Atholl Wood path network. Provides a link to Path 49.	Provides access to Atholl Wood.	Medium
52 Figure 17.1d-e	Local path (un-designated)	Pedestrians	Path 52 provides access to the Tay Forest Park- Craigvinean Plantations and provides a link to Path 45.	Provides access to Tay Forest Park – Craigvinean Plantation.	Medium
53 Figure 17.1e	Local Path (non-designated)	Pedestrians	Path 53 provides direct access to the River Tay from the existing A9. Connects to Path 38/NCR77 and 48/NCR77	Provides access to the River Tay.	Medium

*Although predominant users of the paths are identified, it should be noted that access is not limited to a single user group.

**Refer to Volume 1, Part 3 – Environmental Assessment (Chapter 8: Population – Land Use) and Figure 8.5 for further details on community land and community assets.

17.4 Potential Impacts and Effects

Introduction

17.4.1 The design of each proposed route option has been developed using an iterative process taking due cognisance of physical and environmental constraints and considering constructability. Elements of the design, most notably structures associated with the proposed grade separated junctions, would form 'embedded' mitigation, which would allow safe movement of WCH across the main carriageway alignment. The potential impacts and effects identified in this section take into account the embedded design mitigation included at this stage. This is anticipated to be further developed as part of the DMRB Stage 3 assessment taking into account the WCH access strategy for the A9.

17.4.2 It should be noted that, for safety reasons, there would be no at-grade crossings of the A9 for any proposed route option.

Construction

17.4.3 At this stage in the design, the likely nature and location of the construction activities (e.g. location of construction compounds) has not been finalised. As such, it is not possible to undertake a detailed assessment of impacts on WCH during construction. However, without mitigation, WCH have the potential to be disrupted by:

- temporary diversions of paths, cycleways and minor roads which may increase journey times;
- temporary severance where construction works disrupt or deter WCH from using paths;
- temporary severance of existing at-grade access across roads;
- construction traffic on local roads which may create busier crossing points;
- location of site compounds could reduce accessibility for WCH using paths or recreation areas; and
- changes to the amenity value of the path and cycleway network due to noise, dust, and visual intrusion of the works.

17.4.4 In the absence of mitigation, the disruption to WCH resulting from construction activities would be significant; however, the impacts and effects would be common to all proposed route options although variation to location and extent would occur. Measures to reduce disruption due to construction would be identified during the DMRB Stage 3 assessment, however it is unlikely all potential construction effects would be reduced to below significant.

Operation

<u>Impacts and Effects Common to All Proposed Route Options</u>

17.4.5 The operational phase would have the potential to disrupt WCH across all proposed route options through the following:

- permanent severance of existing paths or routes;
- permanent diversions resulting in journey length increases; and
- permanent reduction to amenity value due to increased noise levels, reduced air quality, disrupted views or safety issues.

Crossing Points

17.4.6 All of the proposed route options would have a potential operational impact on WCH using five crossing points (CP01, CP02, CP04, CP05 and CP06) of the existing A9. A summary of the impact assessment is shown in Table 17.4.

New Conflicts

17.4.7 All of the proposed route options would have potential operational impacts through new conflicts for WCH using 16 WCH routes of which seven are anticipated to be significant (six adverse and one beneficial). Potential impacts and effects on the path network are shown in Table 17.4.

Table 17.4: Potential Impacts and Effects on WCH through New Conflicts – Common to All Proposed Route Options

Path Reference	Path Type	Crossing Point	Description of Potential Impacts	Sensitivity	Change in Journey Length	Change in Amenity Value	Overall Potential Effect
NCR77 (south) Figure 17.1a	National Cycle Route	-	**Journey Length:** No change in journey length is anticipated due to the proposed route options. **Amenity Value:** Due to the provision of a grade separated junction at Murthly (Option ST2A) or Birnam (Options ST2B, ST2C and ST2D), there would be an increase in traffic along the B867 between its intersection with the A9 and the grade separated junction. There would also be adverse impacts on visual amenity on approach to the junction due to the increased visibility of the structure.	Very High	No change	Decrease	Significant
NCR77 (north) Figure 17.1e	National Cycle Route	-	**Journey Length:** All proposed route options include the realignment of the B898 before it ties in with the existing road at approximately ch7400. In the DMRB Stage 2 design, which has not included WCH routes, the northern end of the tie-in for each of the proposed route options currently severs NCR77. It is anticipated that mitigation would be developed as part of the DMRB Stage 3 design for the Preferred Route Option to allow the NCR77 to join and continue along the B898. No change in journey length is expected. **Amenity Value:** Due to the closer proximity and subsequent visual impact from the route of the proposed route options at Dalguise Junction and the realigned B898, there is expected to be a decrease in amenity value for WCH using this route.	Very High	No change	Decrease	Not Significant
Path 7 Figure 17.1a	Local Path (non-designated)	CP01	**Journey Length:** Access to the path from the A9 would be severed by each of the proposed route options and instead access would be provided from the B867. A proposed grade separated crossing is provided for all proposed route options which would incorporate provision for WCH, and this is anticipated to result in an increase in journey length. **Amenity Value:** Due to the provision of a grade separated crossing, safety would be improved for WCH crossing the carriageway at this location. There would be a decrease in visual amenity due to the greater visibility of the proposed route options from Path 7. Overall an increase in amenity value is expected for WCH using this path due to the improved safety of the grade separated crossing.	Medium	Increase	Increase	Not Significant
Path 15 Figure 17.1a-b	Local Path (non-designated)	-	**Journey Length:** The path would be truncated in the west by all of the proposed route options and therefore a decrease in journey length is assumed. **Amenity Value:** There would be a decrease in visual amenity due to the greater visibility of the proposed route options from Path 15.	Low	Decrease	Decrease	Not Significant

Path Reference	Path Type	Crossing Point	Description of Potential Impacts	Sensitivity	Change in Journey Length	Change in Amenity Value	Overall Potential Effect
Path 19 Figure 17.1b	Local Path (non-designated)	-	**Journey Length:** The path would be truncated in the east by all of the proposed route options and therefore a decrease in journey length is assumed. **Amenity Value:** Due to the closer proximity of the path to the proposed route options, there is expected to be a decrease in amenity value for WCH using this route.	Low	Decrease	Decrease	Not Significant
Path 20 Figure 17.1a-b	Core Path	-	**Journey Length:** No change in journey length is anticipated due to the proposed route options. **Amenity Value:** There would be a decrease in visual amenity due to the greater visibility of the proposed route options from Path 20.	High	No change	Decrease	Significant
Path 21 Figure 17.1b	Local Path (non-designated)	-	**Journey Length:** The path would be truncated in the south by all of the proposed route options and therefore a decrease in journey length is assumed. **Amenity Value:** Due to its closer proximity to the proposed route options and subsequent visual impact from the proposed Birnam Junction, there is expected to be a decrease in the amenity value for WCH using this path.	Low	Decrease	Decrease	Not Significant
Path 23 Figure 17.1b-c	Core Path	CP02	**Journey Length:** This path would be severed by all proposed route options and access across the A9 at the existing at-grade crossing (CP02) would be stopped up. WCH would be redirected to cross the proposed route options via an underbridge at the proposed Birnam Junction between the B867 and Perth Road. However, this would be confirmed during DMRB Stage 3 . There is anticipated to be an increase in journey length for WCH using this path and crossing point. **Amenity Value:** Removal of the at-grade crossing point at this location would result in an improvement in safety for WCH and it is expected that they would be redirected to the proposed underbridge as part of Birnam Junction. This would be confirmed as part of the DMRB Stage 3 assessment. There would be a decrease in visual amenity due to the greater visibility of the proposed route options from Path 23. Overall an increase in amenity value is expected for WCH using this path due to the improved safety of the grade separated crossing.	High	Increase	Increase	Significant

Path Reference	Path Type	Crossing Point	Description of Potential Impacts	Sensitivity	Change in Journey Length	Change in Amenity Value	Overall Potential Effect
Path 35 Figure 17.1c-e	Core Path	CP04 CP05	**Journey Length:** In the DMRB Stage 2 design, which has not included WCH routes, the path would be severed by earthworks for all proposed route options at approximately ch4900 and CP04 would be severed at approximately ch4350. As there is no alternative route proposed within the DMRB Stage 2 design, an increase in journey length is therefore assumed. It is anticipated that mitigation would be developed as part of the DMRB Stage 3 design for the Preferred Route Option to maintain connectivity for this path. Additionally, the path would be severed by all proposed route options at approximately ch7450 and by the new access road as part of the Dalguise Junction to the B898. As above, due to the level of design detail at DMRB Stage 2, there is no alternative route proposed within the DMRB Stage 2 design and an increase in journey length is therefore assumed. It is anticipated that mitigation would be developed during DMRB Stage 3 for the Preferred Route Option to maintain connectivity for this path. **Amenity Value:** Due to the closer proximity of the path to the proposed route options and subsequent visual impact from earthworks, there is expected to be a decrease in the amenity value for WCH using this path.	Very High	Increase	Decrease	Significant
Path 39 Figure 17.1c	Core Path	-	**Journey Length:** In the DMRB Stage 2 design, which has not included WCH routes, the path would be severed by earthworks for all proposed route options at approximately ch4400. As there is no alternative route proposed within the DMRB Stage 2 design an increase in journey length is therefore assumed. It is anticipated that mitigation would be developed during DMRB Stage for the Preferred Route Option to maintain connectivity for this path. **Amenity Value:** Due to the closer proximity of the path to the proposed route options and subsequent visual impact from earthworks, there is expected to be a decrease in the amenity value for WCH using this path.	Very High	Increase	Decrease	Significant
Path 41 Figure 17.1c-d	Core Path	-	**Journey Length:** In the DMRB Stage 2 design, which has not included WCH routes, the path would be severed by the left in left out junction to access The Hermitage at approximately ch5250 for all proposed route options. There is anticipated to be realignment of the path at this location to maintain WCH access and connectivity and this would be further developed during DMRB Stage 3. There is not expected to be an increase in journey length. **Amenity Value:** Due to the closer proximity of the path to the proposed route options there is expected to be a decrease in amenity value for WCH using this path.	Very High	No change	Decrease	Not Significant

Path Reference	Path Type	Crossing Point	Description of Potential Impacts	Sensitivity	Change in Journey Length	Change in Amenity Value	Overall Potential Effect
Path 44 Figure 17.1c	Core Path and Right of Way	-	**Journey Length:** In the DMRB Stage 2 design, which has not included WCH routes, the path and its connection to Path 41 would be severed by the left in left out junction to access The Hermitage at approximately ch5250. There is anticipated to be realignment of the path at this location to maintain WCH access and this would be further developed during DMRB Stage 3. There is not expected to be an increase in journey length. **Amenity Value:** Due to the associated earthworks and loss of woodland along the southbound carriageway and at the entrance to the car park there is expected to be a decrease in the amenity value of the path.	Very High	No change	Decrease	Not Significant
Path 45 Figure 17.1d-e	Core Path	-	**Journey Length:** The path would be truncated by the revised B898 alignment and Path 45's existing connection to Path 35 would be severed by all proposed route options at its northern extent (approximately ch7400). Due to the level of design detail at DMRB Stage 2, there is currently no provision within the design for rerouting, therefore there is anticipated to be a change in journey length for WCH using this path. It is anticipated that mitigation would be developed during DMRB Stage 3 for the Preferred Route Option. **Amenity Value:** Due to the closer proximity of the path to the revised B898 alignment associated with the proposed Dalguise Junction, there is expected to be a decrease in the amenity value for WCH using this path.	High	Increase/ Decrease*	Decrease	Significant
Path 47 Figure 17.1d	Local Path (non-designated)	-	**Journey Length:** The existing path would be truncated by all the proposed route options at approximately ch6550 and access to the A9 would be stopped up. There is currently no provision within the design for rerouting, however there is anticipated to be a reduction in journey length for WCH using this path. It is anticipated that mitigation would be developed as part of the DMRB Stage 3 design for the Preferred Route Option. **Amenity Value:** Due to the closer proximity of the path to the proposed route options and subsequent visual impact, there is expected to be a decrease in the amenity value for WCH using this path.	Low	Decrease	Decrease	Not Significant

Path Reference	Path Type	Crossing Point	Description of Potential Impacts	Sensitivity	Change in Journey Length	Change in Amenity Value	Overall Potential Effect
Path 48/NCR77 Figure 17.1e	Core Path and National Cycle Route	CP06	**Journey Length:** The path would remain as a segregated WCH facility across the River Tay Bridge for all proposed route options. There is therefore not expected to be any impact on journey length. **Amenity Value:** It is anticipated that there would be a barrier separating WCH from the carriageway when crossing the Tay Bridge. This would improve the safety for WCH and therefore there is anticipated to be an increase in the amenity value of journeys for WCH using the path.	Very High	No change	Increase	Significant (Beneficial)
Path 53 Figure 17.1e	Local Path (non-designated)	-	**Journey Length:** No change in journey length is anticipated due to the proposed route options. **Amenity Value:** Due to its closer proximity to the proposed route options, there is expected to be a decrease in the amenity value for WCH using this path.	Medium	No change	Decrease	Not Significant

*Where paths are truncated i.e. a section at the start or end of the path is lost and the route option design does not currently include mitigation, for example in the form of re-routing, it cannot be determined whether the change in journey would be an increase or a decrease, however in both cases the impact is considered to be negative.

17.4.8 No impacts on either journey length or amenity value are anticipated as a result of any of the proposed route options for Paths 1, 2, 3, 4, 5, 6, 8, 9, 10, 11, 12, 13, 14, 16, 17, 18, 26, 27, 29, 32, 34/NCR77, 37, 38/NCR77, 40, 42, 43/NCR77, RCR83, 46, 49, 50, 51, and 52, therefore no effects for WCH using these paths are anticipated.

Impacts and Effects Specific to Option ST2A

17.4.9 In addition to the potential impacts and effects common to all proposed route options presented in Table 17.4, there are potential impacts and effects that are specific to Option ST2A. As shown in Table 17.5 there are impacts expected to 11 WCH routes that are specific to Option ST2A, seven of which are assessed as having the potential to be significant effects (six adverse and one beneficial). Five of these WCH routes are anticipated to experience a change in both journey length and amenity value, and six WCH routes are expected to experience a change in amenity value only.

Table 17.5: Potential Impacts and Effects on WCH through New Conflicts - Impacts and Effects specific to Option ST2A

Path Reference	Path Type	Crossing Point Reference	Description of Potential Impacts	Sensitivity	Change in Journey Length	Change in Amenity Value	Potential Effect
Path NCR77 (Little Dunkeld) Figure 17.1b-c	National Cycle Route	-	**Journey Length:** No change in journey length is anticipated due to Option ST2A. **Amenity Value:** Existing traffic flow along Perth Road for Path NCR77 (Little Dunkeld) is approximately 2,200 AADT in 2015, rising to approximately 2,350 in the 2026 Do-Minimum option. This is expected to increase to approximately 3,300 AADT in the 2026 Do Something option for Option ST2A, which is anticipated to result in a decrease in amenity value along this section.	Very High	No change	Decrease	Not Significant
Path 22/NCR77 Figure 17.1b-c	Core Path and National Cycle Route	-	**Journey Length:** The path would be severed by Option ST2A. Post construction, it is anticipated that Path 22/NCR77 would be placed on top of the cut and cover tunnel. Whilst there would be no opportunity for Path 22/NCR77 to continue along Birnam Glen, it could be diverted along Station Road to Perth Road to join Path 25 and then rejoin the existing NCR77 through Little Dunkeld. A decrease in journey length due to the rerouting of the path is anticipated. **Amenity Value:** Due to the WCH route being placed on top of the cut and cover tunnel, it is anticipated that there would be an increase in amenity value along this section as WCH would no longer be travelling adjacent to vehicular traffic.	Very High	Decrease	Increase	Significant (Beneficial)
Path 24 Figure 17.1b-c	Core Path and Right of Way	-	**Journey Length**: No change in journey length is anticipated due to Option ST2A. **Amenity Value:** Due to the closer proximity of the path and subsequent potential visual impact at the proposed junctions at Birnam and Dunkeld, there is expected to be a decrease in the amenity value for WCH using this route.	Very High	No change	Decrease	Significant

Path Reference	Path Type	Crossing Point Reference	Description of Potential Impacts	Sensitivity	Change in Journey Length	Change in Amenity Value	Potential Effect
Path 25 Figure 17.1b-c	Core Path	-	**Journey Length**: No change in journey length is anticipated due to Option ST2A. **Amenity Value:** Visibility of the proposed option is anticipated to be limited along the majority of Path 25 due to existing screening. Existing traffic flow along Perth Road for Path 25 is approximately 1,550 AADT in 2015, rising to approximately 1,900 in the 2026 Do-Minimum option. This is expected to decrease to approximately 1,450 AADT in the 2026 Do Something option for Option ST2A.	Very High	No change	Increase	Not Significant
Path 26a Figure 17.1b-c	Local Path (non-designated)	-	**Journey Length:** The path would be severed at approximately ch3450 as Option ST2A requires lowering of the carriageway, thereby severing the path and its access to the Birnam Glen. Due to the level of design detail at DMRB Stage 2, there is currently no provision within the design for rerouting, therefore an increase in journey length for WCH using this path has been assessed. However, it is anticipated that mitigation could be developed as part of the DMRB Stage 3 design should this be the Preferred Route Option. **Amenity Value:** Due to the closer proximity of the path to the Option ST2A and subsequent potential visual impact, there is anticipated to be a decrease in the amenity value for WCH using this path.	Very High	Increase	Decrease	Significant
Path 28/NCR77 Figure 17.1b-c	Core Path Right of Way and National Cycle Route	CP03	**Journey Length:** The path would be severed by Option ST2A at approximately ch3450 and access across underneath the existing A9 would be stopped up due to the carriageway being lowered. The proposed access road between the A822 (Old Military Road) and Birnam Glen would also sever Path 28 at the Birnam Glen crossing. An alternative crossing via Dunkeld & Birnam Station and Station Road is anticipated, however, this would be developed as part of the DMRB Stage 3 design. An increase in journey length is therefore expected for users of this path in this assessment. **Amenity Value:** Due to the closer proximity of the path to the proposed Birnam Junction and subsequent potential visual impact, there is expected to be a decrease in the amenity value for WCH using this path.	Very High	Increase	Decrease	Significant

Path Reference	Path Type	Crossing Point Reference	Description of Potential Impacts	Sensitivity	Change in Journey Length	Change in Amenity Value	Potential Effect
Path 30 Figure 17.1b-c	Core Path	-	**Journey Length:** The path and its connection to Path 23 would be truncated at its northern extent by the proposed access road between the A822 (Old Military Road) and Birnam Glen. Due to the level of design detail at DMRB Stage 2, there is currently no provision within the design for rerouting, therefore there is anticipated to be a change in journey length for WCH using this path. However, it is anticipated that mitigation could be developed as part of the DMRB Stage 3 design should this be the Preferred Route Option. **Amenity Value:** Due to the closer proximity of the path to the proposed new access road to Dunkeld Junction and subsequent potential visual impact, there is expected to be a decrease in amenity value for WCH using this path.	Very High	Increase/ Decrease*	Decrease	Significant
Path 31 Figure 17.1c	Local Path (non-designated)	-	**Journey Length:** The path would be truncated at its northern extent by the proposed access road between the A822 (Old Military Road) and Birnam Glen. Due to the level of design detail at DMRB Stage 2, there is currently no provision within the design for rerouting, therefore there is anticipated to be a change in journey length for WCH using this path. It is anticipated that mitigation could be developed as part of the DMRB Stage 3 design should this be the Preferred Route Option. **Amenity Value:** Due to the closer proximity of the path to Option ST2A and potential visual impact from the new access road, there is expected to be a decrease in the amenity value for WCH using this path.	High	Increase/ Decrease*	Decrease	Not Significant
Path 31a Figure 17.1c	Local Path (non-designated)	-	**Journey Length:** No change in journey length is anticipated due to Option ST2A. **Amenity Value:** Due to the closer proximity of the path to Option ST2A and potential visual impact from the new access road, there is expected to be a decrease in the amenity value for WCH using this path.	High	No change	Decrease	Not Significant

Path Reference	Path Type	Crossing Point Reference	Description of Potential Impacts	Sensitivity	Change in Journey Length	Change in Amenity Value	Potential Effect
Path 33 Figure 17.1c	Core Path and Right of Way	CP04	**Journey Length:** No change in journey length is anticipated due to Option ST2A. **Amenity Value:** There would be a decrease in the amenity value of this path due to its closer proximity to the proposed roundabout at Dunkeld.	Very High	No change	Decrease	Significant
Path 36 Figure 17.1c	Core Path	-	**Journey Length:** No change in journey length is anticipated due to Option ST2A. **Amenity Value:** There would be a decrease in the amenity value of this path due to its closer proximity to the proposed roundabout at Dunkeld.	Very High	No change	Decrease	Significant

*Where paths are truncated i.e. a section at the start or end of the path is lost and the route option design does not currently include mitigation, for example in the form of re-routing, it cannot be determined whether the change in journey would be an increase or a decrease, however in both cases the potential impact is considered to be adverse.

Impacts and Effects Specific to Option ST2B

17.4.10 In addition to the potential impacts and effects common to all proposed route options presented in Table 17.4, there are potential impacts and effects that are specific to Option ST2B. As shown in Table 17.6 there are potential impacts expected to 11 WCH routes that are specific to Option ST2B, seven of which are assessed as having the potential to be significant effects. Five WCH routes are anticipated to experience both a change in journey length and amenity value and six WCH routes are expected to experience a change in amenity value only.

Table 17.6: Potential Impacts and Effects on WCH through New Conflicts - Impacts and Effects Specific to Option ST2B

Path Reference	Path Type	Crossing Point Reference	Description of Potential Impacts	Sensitivity	Change in Journey Length	Change in Amenity Value	Potential Effect
Path NCR77 (Little Dunkeld) Figure 17.1b-c	National Cycle Route	-	**Journey Length:** No change in journey length is anticipated due to Option ST2B. **Amenity Value:** Existing traffic flow along Perth Road for Path NCR77 (Little Dunkeld) is approximately 2,200 AADT in 2015, rising to approximately 2,350 in the 2026 Do-Minimum option. This is expected to increase to approximately 3,500 AADT in the 2026 Do Something option for Option ST2B, which may result in a decrease in amenity value along this section.	Very High	No change	Decrease	Not Significant

Path Reference	Path Type	Crossing Point Reference	Description of Potential Impacts	Sensitivity	Change in Journey Length	Change in Amenity Value	Potential Effect
Path 22/NCR77 Figure 17.1b-c	Core Path and National Cycle Route	-	**Journey Length:** The path would be severed by Option ST2B for the majority of its route and it is anticipated that WCH would be redirected via Perth Road (Path 25) to then rejoin the existing NCR77 through Little Dunkeld. A decrease in journey length is anticipated. **Amenity Value:** Due to the closer proximity of the path to the proposed Birnam Junction and subsequent potential visual impact, there is expected to be a decrease in the amenity value for WCH using this path. A decrease in amenity is also anticipated due to the change from being a segregated off road WCH route along Perth Road.	Very High	Decrease	Decrease	Significant
Path 24 Figure 17.1b-c	Core Path and Right of Way	-	**Journey Length**: No change. **Amenity Value:** Due to the closer proximity of the path and subsequent potential visual impacts at the proposed junctions at Birnam and Dunkeld, there is expected to be a decrease in the amenity value for WCH using this route.	Very High	No change	Decrease	Significant
Path 25 Figure 17.1b-c	Core Path	-	**Journey Length**: No change in journey length is anticipated due to Option ST2B. **Amenity Value:** Visibility of the proposed route option is anticipated to be limited along the majority of Path 25 due to existing screening. Existing traffic flow along Perth Road for Path 25 is approximately 1,550 AADT in 2015, rising to approximately 1,900 in the 2026 Do-Minimum option. This is expected to increase to approximately 2,000 AADT in the 2026 Do Something option for Option ST2B.	Very High	No change	Decrease	Not Significant
Path 26a Figure 17.1b-c	Local Path (non-designated)	-	**Journey Length:** The path would be severed at approximately ch3450 as Option ST2B requires lowering of the carriageway, therefore severing the path and its access to the Birnam Glen. There is currently no provision within the design for rerouting, therefore there is anticipated to be an increase in journey length for WCH using this path. It is anticipated that mitigation could be developed as part of the DMRB Stage 3 design should this be the Preferred Route Option. **Amenity Value:** Due to the closer proximity of the path to Option ST2B and subsequent potential visual impact, there is anticipated to be a decrease in the amenity value for WCH using this path.	Very High	Increase	Decrease	Significant

Path Reference	Path Type	Crossing Point Reference	Description of Potential Impacts	Sensitivity	Change in Journey Length	Change in Amenity Value	Potential Effect
Path 28/NCR77 Figure 17.1b-c	Core Path Right of Way and National Cycle Route	CP03	**Journey Length:** The path would be severed by Option ST2B at ch3450 and access underneath the existing A9 would be stopped up due to the carriageway being lowered. The proposed access road between the A822 (Old Military Road) and Birnam Glen would also sever Path 28 at the Birnam Glen crossing. An alternative crossing via Dunkeld & Birnam Station and Station Road is anticipated however this would be developed during DMRB Stage 3. An increase in journey length is therefore assessed at this stage for users of this path. **Amenity Value:** Due to the closer proximity of the path to the proposed Birnam Junction and subsequent potential visual impact, there is expected to be a decrease in the amenity value for WCH using this path.	Very High	Increase	Decrease	Significant
Path 30 Figure 17.1b-c	Core Path	-	**Journey Length:** The path and its connection to Path 23 would be truncated at its northern extent by the proposed access road between the A822 (Old Military Road) and Birnam Glen. Due to the level of design detail at DMRB Stage 2, there is currently no provision within the design for rerouting, therefore there is anticipated to be a change in journey length for WCH using this path. It is anticipated that mitigation could be developed as part of the DMRB Stage 3 design should this be the Preferred Route Option. **Amenity Value:** Due to the closer proximity of the path to the proposed new access road to Dunkeld Junction and subsequent potential visual impact, there is expected to be a decrease in amenity value for WCH using this path.	Very High	Increase/ Decrease	Decrease	Significant
Path 31 Figure 17.1c	Local Path (non-designated)	-	**Journey Length:** The path would be truncated at its northern extent by the proposed access road between the A822 (Old Military Road) and Birnam Glen. Due to the level of design detail at DMRB Stage 2, there is currently no provision within the design for rerouting, therefore there is anticipated to be a change in journey length for WCH using this path. It is anticipated that mitigation could be developed as part of the DMRB Stage 3 design should this be the Preferred Route Option. **Amenity Value:** Due to the closer proximity of the path to Option ST2B and potential visual impact from the new access road, there is expected to be a decrease in the amenity value for WCH using this path.	High	Increase/ Decrease*	Decrease	Not Significant

Path Reference	Path Type	Crossing Point Reference	Description of Potential Impacts	Sensitivity	Change in Journey Length	Change in Amenity Value	Potential Effect
Path 31a Figure 17.1c	Local Path (non-designated)	-	**Journey Length:** No change in journey length is anticipated due to Option ST2B. **Amenity Value:** Due to the closer proximity of the path to Option ST2B and potential visual impact from the new access road, there is expected to be a decrease in the amenity value for WCH using this path.	High	No change	Decrease	Not Significant
Path 33 Figure 17.1c	Core Path and Right of Way	CP04	**Journey Length:** No change in journey length is anticipated due to Option ST2B. **Amenity Value**: There would be a decrease in the amenity value of this path due to its closer proximity to the proposed roundabout at Dunkeld.	Very High	No change	Decrease	Significant
Path 36 Figure 17.1c	Core Path	-	**Journey Length:** No change in journey length is anticipated due to Option ST2B. **Amenity Value:** There would be a decrease in the amenity value of this path due to its closer proximity to the proposed roundabout at Dunkeld.	Very High	No change	Decrease	Significant

Impacts and Effects Specific to Option ST2C

17.4.11 In addition to the potential impacts and effects common to all proposed route options presented in Table 17.4, there are potential impacts that are specific to Option ST2C. As shown in Table 17.7 there are potential impacts expected to eight WCH routes that are specific to Option ST2C, of which six are assessed as having the potential for significant effects. Five WCH routes are anticipated to experience a change in both journey length and amenity value and three WCH routes are expected to experience a change in amenity value only.

Table 17.7: Potential Impacts and Effects on WCH through New Conflicts - Impacts and Effects specific to Option ST2C

Path Reference	Path Type	Crossing Point Reference	Description of Potential Impacts	Sensitivity	Change in Journey Length	Change in Amenity Value	Potential Effect
Path NCR77 (Little Dunkeld) Figure 17.1b-c	National Cycle Route	-	**Journey Length:** No change in journey length is anticipated due to Option ST2C. **Amenity Value:** Existing traffic flow along Perth Road for Path NCR77 (Little Dunkeld) is approximately 2,200 AADT in 2015, rising to approximately 2,350 in the 2026 Do-Minimum option. This is expected to increase to approximately 3,100 AADT in the 2026 Do Something option for Option ST2C, which may result in a decrease in amenity value along this section.	Very High	No change	Decrease	Not Significant

Path Reference	Path Type	Crossing Point Reference	Description of Potential Impacts	Sensitivity	Change in Journey Length	Change in Amenity Value	Potential Effect
Path 22/NCR77 Figure 17.1b-c	Core Path and National Cycle Route	-	**Journey Length:** The path would be severed by Option ST2C for the majority of its route and it is anticipated that WCH would be redirected via Perth Road (Path 25) to then re-join the existing NCR77 through Little Dunkeld. A decrease in journey length is anticipated. **Amenity Value:** Due to the closer proximity of the path to the proposed Birnam Junction and subsequent potential visual impact, there is expected to be a decrease in the amenity value for WCH using this path. A decrease in amenity is also anticipated due to the change from being a segregated off road WCH route to along Perth Road.	Very High	Decrease	Decrease	Significant
Path 24 Figure b-c	Core Path and Right of Way	CP04	**Journey Length**: This path would be severed by the retaining wall at ch4300. Due to the level of design detail at DMRB Stage 2, there is no alternative route proposed within the DMRB Stage 2 design and an increase in journey length is therefore assumed. It is anticipated that mitigation could be developed as part of the DMRB Stage 3 design should this be the Preferred Route Option. **Amenity Value:** Due to the closer proximity of the path and subsequent potential visual impact at the proposed junctions at Birnam and Dunkeld, there is expected to be a decrease in the amenity value for WCH using this route.	Very High	Increase	Decrease	Significant
Path 25 Figure 17.1b-c	Core Path	-	**Journey Length:** No change in journey length is anticipated due to Option ST2C. **Amenity Value:** Visibility of the proposed option is anticipated to be limited along the majority of Path 25 due to existing screening. Existing traffic flow along Perth Road for Path 25 is approximately 1,550 AADT in 2015, rising to approximately 1,900 in the 2026 Do-Minimum option. This is expected to increase to approximately 2,400 AADT in the 2026 Do Something option for Option ST2C.	Very High	No change	Decrease	Not Significant

Path Reference	Path Type	Crossing Point Reference	Description of Potential Impacts	Sensitivity	Change in Journey Length	Change in Amenity Value	Potential Effect
Path 26a Figure 17.1b-c	Local Path (non-designated)	-	**Journey Length:** In the DMRB Stage 2 design, which has not included WCH routes, this path would be severed by the earthworks associated with the proposed Birnam Glen and Inchewan Burn Underbridge. As there is no alternative route proposed within the DMRB Stage 2 design, an increase in journey length is therefore assumed. It is anticipated that mitigation could be developed as part of the DMRB Stage 3 design should this be the Preferred Route Option. **Amenity Value:** Due to the closer proximity of the path to Option ST2C and the potential visual impact from the new earthworks, a decrease in amenity value is anticipated for WCH using Path 26a.	Very High	Increase	Decrease	Significant
Path 28/NCR77 Figure 17.1b-c	Core Path Right of Way and National Cycle Route	CP03	**Journey Length:** WCH access along Path 28/NCR77 is maintained for Option ST2C therefore no change in journey length is anticipated. **Amenity Value:** Due to the wider overbridge across the Birnam Glen for the proposed A9 carriageway, a decrease in amenity is anticipated for WCH using Path 28/NCR77 for Option ST2C.	Very High	No change	Decrease	Significant
Path 33 Figure 17.1c	Core Path and Right of Way	CP04	**Journey Length:** The path would be severed by the proposed Dunkeld Junction at approximately ch4200. Based on the level of design detail available at DMRB Stage 2, there is no alternative route proposed within the DMRB Stage 2 design and an increase in journey length is therefore assumed. It is anticipated that mitigation could be developed as part of the DMRB Stage 3 design should this be the Preferred Route Option. **Amenity Value:** Due to the closer proximity of the path to the proposed Dunkeld Junction and subsequent increased visibility of the junction, there is expected to be a decrease in the amenity value for WCH using this path.	Very High	Increase	Decrease	Significant

Path Reference	Path Type	Crossing Point Reference	Description of Potential Impacts	Sensitivity	Change in Journey Length	Change in Amenity Value	Potential Effect
Path 36 Figure 17.1c	Core Path	-	**Journey Length:** The path would be severed by the proposed Dunkeld Junction and realigned Inver Mill access at approximately ch4300. Based on the level of design detail available at DMRB Stage 2, there is no alternative route proposed within the DMRB Stage 2 design and an increase in journey length is therefore assumed. It is anticipated that mitigation could be developed as part of the DMRB Stage 3 design should this be the Preferred Route Option. **Amenity Value:** There would be a decrease in the amenity value of this path due to its closer proximity to the proposed junction at Dunkeld.	Very High	Increase	Decrease	Significant

Impacts and Effects Specific to Option ST2D

17.4.12 In addition to the potential impacts and effects common to all proposed route options presented in Table 17.4, there are potential impacts that are specific to Option ST2D. As shown in Table 17.8 there are potential impacts expected to eight WCH routes that are specific to Option ST2D, of which six are assessed as having the potential for significant effects. Two WCH routes are anticipated to experience a change in both journey length and amenity value and six WCH routes are expected to experience a change in amenity value only.

Table 17.8: Potential Impacts and Effects on WCH through New Conflicts - Impacts and Effects specific to Option ST2D

Path Reference	Path Type	Crossing Point Reference	Description of Potential Impacts	Sensitivity	Change in Journey Length	Change in Amenity Value	Potential Effect
Path NCR77 (Little Dunkeld) Figure 17.1b-c	National Cycle Route	-	**Journey Length:** No change in journey length is anticipated due to Option ST2D. **Amenity Value:** Existing traffic flow along Perth Road for Path NCR77 (Little Dunkeld) is approximately 2,200 AADT in 2015, rising to approximately 2,350 in the 2026 Do-Minimum option. This is expected to increase to approximately 3,500 AADT in the 2026 Do Something option for Option ST2D, which is anticipated to result in a decrease in amenity value along this section.	Very High	No change	Decrease	Not Significant

Path Reference	Path Type	Crossing Point Reference	Description of Potential Impacts	Sensitivity	Change in Journey Length	Change in Amenity Value	Potential Effect
Path 22/NCR77 Figure 17.1b-c	Core Path and National Cycle Route	-	**Journey Length:** The path would be severed by Option ST2D for the majority of its route and it is anticipated that WCH would be redirected via Perth Road (Path 25) to then rejoin the existing NCR77 through Little Dunkeld. A decrease in journey length is anticipated. **Amenity Value:** Due to the closer proximity of the path to the proposed Birnam Junction and subsequent visual potential impact, there is expected to be a decrease in the amenity value for WCH using this path. A decrease in amenity is also anticipated due to the change from being a segregated off road WCH route to along Perth Road.	Very High	Decrease	Decrease	Significant
Path 24 Figure b-c	Core Path and Right of Way	-	**Journey Length**: No change in journey length is anticipated due to Option ST2D. **Amenity Value:** Due to the closer proximity of the path and subsequent potential visual impact at the proposed junctions at Birnam and Dunkeld, there is expected to be a decrease in the amenity value for WCH using this route.	Very High	No change	Decrease	Significant
Path 25 Figure 17.1b-c	Core Path	-	**Journey Length**: No change in journey length is anticipated due to Option ST2D. **Amenity Value:** Visibility of the proposed option is anticipated to be limited along the majority of Path 25 due to existing screening. Existing traffic flow along Perth Road for Path 25 is approximately 1,550 AADT in 2015, rising to approximately 1,900 in the 2026 Do-Minimum option. This is expected to increase to approximately 2,000 AADT in the 2026 Do Something option for Option ST2D.	Very High	No change	Decrease	Not Significant
Path 26a Figure 17.1b-c	Local Path (non-designated)	-	**Journey Length:** Due to the level of design detail at DMRB Stage 2, this path would be severed by the earthworks associated with the proposed Birnam Glen and Inchewan Burn Underbridge. As there is no alternative route proposed within the DMRB Stage 2 design, an increase in journey length is therefore assumed. It is anticipated that mitigation could be developed during DMRB Stage 3 should this be the Preferred Route Option. **Amenity Value:** Due to the closer proximity of the path to Option ST2D and the potential visual impact from the new earthworks, a decrease in amenity value is anticipated for WCH using Path 26a.	Very High	Increase	Decrease	Significant

Path Reference	Path Type	Crossing Point Reference	Description of Potential Impacts	Sensitivity	Change in Journey Length	Change in Amenity Value	Potential Effect
Path 28/NCR77 Figure 17.1b-c	Core Path Right of Way and National Cycle Route	CP03	**Journey Length:** WCH access along Path 28/NCR77 is maintained for Option ST2D therefore no change in journey length is anticipated. **Amenity Value:** Due to the wider overbridge across the Birnam Glen for the proposed A9 carriageway, a decrease in amenity is anticipated for WCH using Path 28/NCR77 for Option ST2D.	Very High	No change	Decrease	Significant
Path 33 Figure 17.1c	Core Path and Right of Way	CP04	**Journey Length:** No change in journey length is anticipated due to Option ST2D. **Amenity Value:** There would be a decrease in the amenity value of this path due to its closer proximity to the proposed roundabout at Dunkeld.	Very High	No change	Decrease	Significant
Path 36 Figure 17.1c	Core Path	-	**Journey Length:** No change in journey length is anticipated due to Option ST2D. **Amenity Value:** There would be a decrease in the amenity value of this path due to its closer proximity to the proposed roundabout at Dunkeld.	Very High	No change	Decrease	Significant

17.5 Potential Mitigation

17.5.1 A WCH Access Strategy for the A9 Dualling Programme has been developed, the principles of which have influenced the potential mitigation at the DMRB Stage 2 assessment and would be further considered as part of the DMRB Stage 3 assessment. This includes mitigation measures embedded into the detailed design such as the provision of crossing points and details of any re-routing required for the affected paths. The potential significant impacts identified in this assessment would be reviewed as part of the DMRB Stage 3 assessment for the Preferred Route Option and mitigation considered to reduce potential impacts further.

Construction

17.5.2 Under the Land Reform (Scotland) Act 2003, the Contractor would be required to maintain access along paths during construction, for example in the form of temporary diversions.

17.5.3 Typical potential mitigation measures during construction would include:

- Programming the construction works in such a manner to reduce the length of closures or restrictions of access as far as practicable.
- Fencing of the construction site and restriction of access to non-authorised personnel.
- Temporary diversion routes should be provided to maintain access for WCH throughout the works, and any closure or re-routing of routes used by WCH should be agreed in advance with the local authorities.
- Any diversion routes should aim to be designed in accordance with the guidance provided in 'Roads for All - Good Practice Guide for Roads' (Transport Scotland, 2013b) where practicable.
- Where necessary, bus stops should be relocated safely with a safe access route provided for WCH.
- Best practicable means should be employed to avoid the creation of a statutory nuisance associated with noise, dust and air pollution. Further information on mitigation in relation to air and noise is provided in Volume 1, Part 3 – Environmental Assessment (Chapter 15: Air Quality) and Volume 1, Part 3 – Environmental Assessment (Chapter 16: Noise and Vibration).
- Reasonable precautions should be taken to reduce the potential visual impact of the construction works where practicable. Further information on mitigation in relation to this is provided in Volume 1, Part 3 – Environmental Assessment (Chapter 12: Landscape and Chapter 13: Visual).

Operation

17.5.4 Typical potential mitigation measures during operation would include:

- Diversion or re-routing of existing paths to provide relief from severance and maintain access.
- Creation of new paths/cycleways to provide relief from severance and maintain access.
- The requirements of the Equality Act (2010) and guidance provided in 'Roads for All - Good Practice Guide for Roads' (Transport Scotland, 2013b) should be incorporated into the design wherever practicable, e.g. any bridges, ramps or footpaths should take into account potential barriers to people with reduced mobility such as the gradient or surfacing.
- Surfacing of any new paths alongside roads should be considered with regard to the type of user and should comply with current standards.
- Cycling provision can be improved by including designated cycle lanes and clear signage.
- New cycleways/footpaths should use non-frost susceptible materials to reduce risk of degradation.

17.5.5 The amenity value of paths can also be improved as a result of mitigation measures included elsewhere in this DMRB Stage 2 assessment, specifically potential measures for landscape and visual (set out in Volume 1, Part 3 – Environmental Assessment (Chapter 12: Landscape) and air quality and noise (set out in Volume 1, Part 3 – Environmental Assessment (Chapter 15: Air Quality and Chapter 16: Noise and Vibration respectively).

17.5.6 The amenity value of paths could also be improved through exploiting opportunities to improve and enhance WCH provision, for example increasing separation between key paths and the A9 corridor. These would be developed in line with the A9 WCH Access Strategy whilst taking into account the restrictions associated with Compulsory Purchase procedures.

17.6 Summary of Route Options Assessment

17.6.1 This section provides a summary of the DMRB Stage 2 assessment of potential significant residual effects of the proposed route options taking into account 'embedded' mitigation measures incorporated in the designs of the proposed route options (e.g. alignment, design elements, grading out of earthworks), and the potential mitigation measures described in Section 17.5. Professional judgement has been used to consider the likely mitigating effects of more detailed landscape mitigation, which would be developed during DMRB Stage 3 for the Preferred Route Option and would include measures such as replacement woodland planting to screen views and enhance landscape integration. As this level of mitigation detail is not available at DMRB Stage 2, the potential residual effects in this summary section are necessarily precautionary (i.e. it may be possible to further reduce stated potential effects at DMRB Stage 3).

17.6.2 For the comparison of proposed route options, two aspects are considered; whether the potential for residual effects would be considered significant in the context of the EIA Regulations; and whether any of the potential impacts and effects identified differ sufficiently between proposed route options such that they can be considered a differentiator and need to be considered as part of the overall identification of the Preferred Route Option, which takes into account environmental considerations as well as engineering, economic and traffic considerations.

Walkers, Cyclists and Horse-Riders (WCH)

17.6.3 The DMRB Stage 2 assessment of WCH has identified potential significant effects associated with the proposed route options as shown in Tables 17.4 to 17.8. A summary of these potential significant effects is presented in Table 17.9. Although there are slight differences between the proposed route options in terms of number and types of impacts and effects as outlined below, these are not considered sufficient to differentiate between the proposed route options.

17.6.4 There are significant potential adverse effects on six WCH routes and one significant potential beneficial effect on one WCH route common to all proposed route options as shown in Table 17.4.

17.6.5 In terms of the potential effects specific to specific proposed route options as shown in Tables 17.5 to 17.8:

- Option ST2A would have significant potential adverse effects on an additional six WCH routes, and significant potential beneficial effects on one additional WCH route;
- Option ST2B would have significant potential adverse effects on an additional seven WCH routes; and
- Option ST2C and Option ST2D would have significant potential adverse effects on an additional six WCH routes.

17.6.6 Option ST2B, Option ST2C, and Option ST2D would result in Path 22/NCR77 being severed. It is therefore anticipated that WCH would be rerouted across the new grade separated crossing at Birnam Junction then along Perth Road (Path 25), before rejoining the existing NCR77 at the junction with Station Road. Existing traffic flows along Perth Road are approximately 1,507 (AADT 18hr) with a 30mph speed limit in place along the majority of the route. For Option ST2B, Option ST2C and Option ST2D, WCH travelling along NCR77 between Birnam Junction and the junction with Station Road would therefore experience a decrease in amenity value compared to the existing NCR77 route due to now encountering traffic flows on this section.

17.6.7 Path 22/NCR77 would be severed by Option ST2A, however post-construction, it is anticipated that Path 22/NCR77 would be placed on top of the 1.5km cut and cover tunnel. Whilst there would no opportunity for Path 22/NCR77 to continue along Birnam Glen, it could be diverted along Station Road to Perth Road to join Path 25 and then rejoin the existing NCR77 through Little Dunkeld. With the WCH route on top of the 1.5km cut and cover tunnel, it is anticipated that there would be an increase in amenity value along this section as WCH would no longer be travelling adjacent to vehicular traffic.

Table 17.9: Summary of Assessment – Population – Accessibility

Chapter/ Subcategory		Residual Effects				Comments
		Option ST2A	Option ST2B	Option ST2C	Option ST2D	
Effects on Accessibility	Construction	At this stage in the design, the likely nature and location of the construction activities (e.g. location of construction compounds) is unknown. As such, it is not possible to undertake a detailed assessment of impacts on WCH during construction. In general, the disruption to WCH as a result of construction activities is anticipated to have the potential for a significant effect; however, this would be common to all route options. Mitigation to reduce construction impacts and effects would be developed during the DMRB Stage 3 assessment.				Construction impacts and effects on journey length and amenity value are not considered to be differentiators between proposed route options.
	Operation	**Significant Adverse Effects (12 Routes):** NCR77 (South): Decrease in Amenity Value Path 20: Decrease in Amenity Value Path 23: Increase in Journey Length, Increase in Amenity Value Path 24: Decrease in Amenity Value Path 26a: Increase in Journey Length, Decrease in Amenity Value Path 28/NCR77: Increase in Journey Length Decrease in Amenity Value Path 30: Increase/Decrease Journey Length, Decrease in Amenity Value	**Significant Adverse Effects (13 Routes):** NCR77 (South): Decrease in Amenity Value Path 20: Decrease in Amenity Value Path 22/NCR77: Decrease in Journey Length, Decrease in Amenity Value Path 23: Increase in Journey Length, Increase in Amenity Value Path 24: Decrease in Amenity Value Path 26a: Increase in Journey Length, Decrease in Amenity Value	**Significant Adverse Effects (12 Routes):** NCR77 (South): Decrease in Amenity Value Path 20: Decrease in Amenity Value Path 22/NCR77: Decrease in Journey Length, Decrease in Amenity Value Path 23: Increase in Journey Length, Increase in Amenity Value Path 24: Increase in Journey Length, Decrease in Amenity Value Path 26a: Increase in Journey Length, Decrease in Amenity Value	**Significant Adverse Effects (12 Routes):** NCR77 (South): Decrease in Amenity Value Path 20: Decrease in Amenity Value Path 22/NCR77: Decrease in Journey Length, Decrease in Amenity Value Path 23: Increase in Journey Length, Increase in Amenity Value Path 24: Decrease in Amenity Value Path 26a: Increase in Journey Length, Decrease in Amenity Value	The differences in significant effects during operation between proposed route options are not considered sufficient to be a differentiator.

Chapter/ Subcategory		Residual Effects				Comments
		Option ST2A	Option ST2B	Option ST2C	Option ST2D	
Effects on Accessibility	Operation	Path 33: Decrease in Amenity Value Path 35: Increase in Journey Length, Decrease in Amenity Value Path 36: Decrease in Amenity Value Path 39: Increase in Journey Length, Decrease in Amenity Value Path 45: Increase/Decrease Journey Length, Decrease in Amenity Value **Significant Beneficial Effect (Two Routes)** Path 22/NCR77: Decrease in Journey Length, Increase in Amenity Value Path 48/NCR77: Increase in Amenity Value	Path 28/NCR77: Increase in Journey Length, Decrease in Amenity Value Path 30: Increase/Decrease Journey Length, Decrease in Amenity Value Path 33: Decrease in Amenity Value Path 35: Increase in Journey Length, Decrease in Amenity Value Path 36: Decrease in Amenity Value Path 39: Increase in Journey Length, Decrease in Amenity Value Path 45: Increase/Decrease Journey Length, Decrease in Amenity Value **Significant Beneficial Effect (One Route)** Path 48/NCR77: Increase in Amenity Value	Path 28/NCR77: Decrease in Amenity Value Path 33: Decrease in Amenity Value Path 35: Increase in Journey Length, Decrease in Amenity Value Path 36: Increase in Journey Length, Decrease in Amenity Value Path 39: Increase in Journey Length, Decrease in Amenity Value Path 45: Increase/Decrease Journey Length, Decrease in Amenity Value **Significant Beneficial Effect (One Route)** Path 48/NCR77: Increase in Amenity Value	Path 28/NCR77: Decrease in Amenity Value Path 33: Decrease in Amenity Value Path 35: Increase in Journey Length, Decrease in Amenity Value Path 36: Decrease in Amenity Value Path 39: Increase in Journey Length, Decrease in Amenity Value Path 45: Increase/Decrease Journey Length, Decrease in Amenity Value **Significant Beneficial Effect (One Route** Path 48/NCR77: Increase in Amenity Value	

Compliance Against Plans and Policies

17.6.8 DMRB LA 104 states that environmental assessment, reporting and monitoring shall meet the requirements of the national planning policy for each relevant Overseeing Organisation.

17.6.9 *Appendix A21.1 (Assessment of Policy Compliance)* provides a review of national, regional and local policy documents which are of relevance to this assessment undertaken and reported in this chapter in accordance with DMRB guidance.

17.6.10 National Planning Policy objectives (and accompanying best practice guidance) of relevance to this assessment are provided in the National Planning Framework 3 (NPF3) (Scottish Government, 2014a), Scottish Planning Policy (SPP) (Scottish Government, 2014b; Revised 2020), the National Transport Strategy 2 (NTS2) (Transport Scotland, 2020), as well as PAN 75 (Planning for Transport) (Scottish Executive, 2005), PAN 77 (Designing Safer Places) (Scottish Executive, 2006a) and PAN 78 (Inclusive Design) (Scottish Executive, 2006b). In addition, local policies of relevance include Perth and Kinross Local Development Plan 2 (PKC LDP2) (PKC, 2019) Policies 1 (Placemaking), 15 (Public Access) and 60 (Transport Standards and Accessibility Requirements), as well as TAYplan Policy 2 (Shaping Better Quality Places) (TAYplan, 2017).

17.6.11 A full policy compliance assessment can be found in Table 9 of *Appendix A21.1 (Assessment of Policy Compliance).* It is assessed that although all proposed route options would result in potential impacts upon WCH routes during operation, the development of the WCH Access Strategy outlines mitigation measures to reduce impacts upon WCH access, which will be further considered for the preferred route option as part of the DMRB Stage 3 assessment. As such, with the further consideration of mitigation at DMRB Stage 3, it is anticipated that all proposed route options would comply with national, regional and local policy.

Community Objectives

17.6.12 The community objectives (refer to Volume 1, Part 3 – Environmental Assessment (Chapter 7: Overview of Environmental Assessment, Table 7.2)) have been considered throughout DMRB Stage 2. *Appendix A7.1: Mapping of Community Objectives Against DMRB Stage 2 Route Options* sets out which DMRB Stage 2 environmental topics are relevant to each of the objectives.

17.6.13 *Appendix A7.1: Mapping of Community Objectives Against DMRB Stage 2 Route Options* confirms that community objectives 3, 5 and 6 are relevant to the assessment of Population – Accessibility. Professional judgement has been used to consider how the proposed route options contribute to these community objectives for the operation phase, as summarised in Table 17.10.

17.6.14 The contribution of the operation phase of each of the proposed route options to the relevant community objectives was categorised according to the following key.

Contributes to all/most of the community objective

Contributes to part of the community objective

Contributes to little/none of the community objective

Table 17.10: Contribution to Community Objectives During Operation for this Environmental Topic

Relevant Community Objective		Option ST2A	Option ST2B	Option ST2C	Option ST2D
3	Provide better, safer access on and off the A9 from both sides of the road while ensuring easy, safe movement of vehicular traffic and WCH through the villages, helping to reduce stress and anxiety and support the local community.				
5	Examine and identify opportunities to enhance the levels of cycling and walking for transport and leisure, including the improvement of existing footpaths and cycle ways, to promote positive mental health and well-being.				
6	Ensure that all local bus, intercity bus services and train services are maintained and improved.				

17.6.15 There may be some disruption to WCH paths, bus and rail during construction but during operation, all proposed route options would be considered to contribute to most of the applicable community objectives as;

- WCH would no longer be permitted to cross the A9 at-grade for all proposed route options, enhancing their safety and that of vehicle travellers;
- the continuity of the national cycle route would be maintained in the vicinity of the proposed route options; and
- bus services would be maintained during operation and expected to improve due to the dual carriageway increasing journey reliability through a reduction of road closures from collisions, in line with the A9 dualling objectives.

17.7 Scope of DMRB Stage 3 Assessment

17.7.1 It is proposed that the Stage 3 assessment for Population – Accessibility would be undertaken in accordance with the DMRB. It is anticipated the DMRB Stage 3 assessment would include the following:

- confirmation of the information gathered from relevant statutory bodies and local councils including types of users through desk-based assessment and site visits;
- undertake additional consultation with relevant organisations e.g. NatureScot, local councils, ScotWays, Sustrans, British Horse Society and local outdoor access groups;
- update and define the level of impact significance for changes in journey length and amenity, taking into account embedded mitigation developed at DMRB Stage 3;
- refine the DMRB Stage 2 assessment of the amenity value of paths using traffic flow data and the DMRB Stage 3 visual assessment;
- propose appropriate mitigation measures based on refined assessments; and
- identify any further mitigation, including input where appropriate into aspects such as signage and lighting.

17.8 References

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18. Material Assets and Waste

18.1 Introduction

18.1.1 This chapter presents the results of the Material Assets and Waste assessment undertaken as part of the Design Manual for Roads and Bridges (DMRB) Stage 2 Environmental Assessment for the A9 Dualling Pass of Birnam to Tay Crossing.

18.1.2 This assessment has been prepared with reference to Highways England *et al.* (2020) 'DMRB LA 110 Material assets and waste' (DMRB LA 110) which is the published Sustainability and Environment Appraisal standard for assessing the impacts associated with this factor. This includes a comparative assessment of the potential environmental impacts and effects related to the use and consumption of material assets and the production and management of waste, that can reasonably be anticipated with the construction of the proposed route options (noting that operational impacts have been scoped out of this assessment for the reasons identified in paragraph 18.2.18).

18.1.3 The assessment of impacts and effects on material assets and waste has been informed by relevant information collated by other environmental factors, notably Volume 1, Part 3 - Environmental Assessment Chapter 9 (Geology, Soils and Groundwater) for information of mineral resources, peat deposits and sources of hazardous (or special) waste. The assessment of effects on material assets and waste has also been used to inform other environmental factors, notably Volume 1, Part 3 - Environmental Assessment (Chapter 19: Climate), for quantifying embodied carbon emissions associated with use of material assets.

Legislative and Policy Background

18.1.4 The use and consumption of material assets the production and management of waste are subject to a complex framework of legislation and policy at the National, Local and Client level.

18.1.5 In addition to material assets and waste-specific policies, legislation and guidance, there is also the legislative framework for sustainable development which must be considered in assessing the impacts and effects of material assets and waste management.

18.1.6 The key legislative, policy, plans and statutory guidance influencing the design, construction and assessment of the proposed route options are identified below. This includes any emerging plans, where applicable and appropriate. As described in Volume 1, Part 3 - Environmental Assessment (Chapter 7: Overview of Environmental Assessment) relevant pre-Brexit EU legislation now transposed into UK law is also referenced.

European Level:

- The EU Circular Economy Package, 2018;
- Council Directive 1999/31/EC of 26 April 1999 on the landfill of waste;
- The EU Waste Framework Directive 2008/98/EC.

National Level:

- Department for International Development Agenda 2030: Delivering the Global Goals, 2017;
- Scottish Government, Climate Change and Land Reform, The Environment Strategy for Scotland: vision and outcomes, 2020;
- Scottish Government, Climate Change Plan: third report on proposals and policies 2018-2032 (RPP3), 2018;

- Scottish Executive, Choosing our Future Scotland's Sustainable Development Strategy, 2005;
- Scottish Government National Planning Framework 3, 2014;
- Scottish Government Scottish Planning Policy, 2014 (Revised 2020);
- Scottish Government Planning and waste management advice, 2015;
- The Climate Change (Scotland) Act 2009 (as amended);
- Scottish Government Update to the Climate Change Plan 2018 - 2032 Securing a Green Recovery on a Path to Net Zero, 2020;
- Scottish Government, Making Things Last A Circular Economy Strategy for Scotland, 2016;
- Scottish Government, Safeguarding Scotland's Resources - Blueprint for a More Resource Efficient and Circular Economy, 2013;
- Scottish Forestry, Scotland's Forestry Strategy 2019-2029;
- Scottish Procurement Directorate, Scottish Procurement Policy Note SPPN 09/2004 Procurement of Timber and Timber Products;
- Scottish Government, Scotland's Zero Waste Plan, 2010;
- The Waste (Scotland) Regulations 2012 (as amended);
- The Waste (Scotland) Regulations 2011 (as amended);
- The Waste Management Licensing (Scotland) Regulations 2011 (as amended);
- The Environmental Protection (Duty of Care) (Scotland) Regulations 2014 (as amended);
- The Controlled Waste (Registration of Carriers and Seizure of Vehicles) Regulations 1991 (as amended);
- Pollution Prevention and Control (Scotland) Regulations 2012 (as amended);
- The Landfill (Scotland) Regulations 2003 (as amended);
- The Environmental Protection Act 1990 (as amended);
- The Special Waste Regulations 1996 (as amended);
- Waste Electrical and Electronic Equipment (WEEE) Regulations 2013 (as amended);
- The Waste Batteries and Accumulators Regulations 2009 (as amended); and
- Landfill Tax (Scotland) Act 2014 (as amended).

Local Level:

- TAYplan: Strategic Development Plan (2016-2036), 2017; and
- Perth & Kinross Council Local Development Plan 2 (including Supplementary Planning Guidance 0 Delivering Zero Waste), 2019.

Client Level:

- Transport Scotland, National Transport Strategy 2, 2020;
- Transport Scotland, Corporate Plan 2017–20, 2017;
- Transport Scotland, Road Asset Management Plan for Scottish Trunk Roads, 2016.
- Transport Scotland, The Strategic Environmental Design Principles, 2014;
- Transport Scotland, A9 Dualling Programme Sustainability Strategy, 2016;

- Transport Scotland, A9 Dualling Programme: Pass of Birnam to Glen Garry, Waste and Materials Management Strategy, 2019;
- Highways England *et al*, DMRB, GG 103 Introduction and general requirements for sustainable development and design, 2019;
- Highways England *et al*, DMRB, LA 110 Material assets and waste, 2019; and

Guidance:

- SEPA, Guidance - IS IT WASTE Understanding the definition of waste, 2006;
- SEPA *et al*., Technical Guidance WM3: Waste Classification, 2015;
- SEPA, Guidance - Recycled Aggregates from Inert Waste, 2013;
- SEPA *et al*., Guidance on the Production of Fully Recovered Asphalt Road Planings, 2008;
- SEPA, Land Remediation and Waste Management Guidelines, 2009;
- SEPA, Regulatory Guidance - Promoting the Sustainable Reuse of Greenfield Soils in Construction, 2010;
- SEPA, Guidance - Management of Forestry Waste, 2017;
- SEPA, Use of Trees Cleared to Facilitate Development on Afforested Land, 2014;
- SEPA, Guidance on Disposal of trees and plants infected with specific plant diseases, 2013;
- SEPA, Technical Guidance Note, On-site management of Japanese Knotweed and associated contaminated soils, 2008;
- SEPA, Guidance - Asbestos in Demolition Waste, 2015;
- Scottish Government, Duty of Care Code of Practice, 2012;
- SEPA, Technical Guidance on Activities Exempt from Waste Management Licensing, n.d;
- SEPA *et al*., PPG 6: Working at Construction and Demolition Sites, 2012;
- SEPA, A Guide to Consigning Special Waste, 2006; and
- Revenue Scotland, Scottish Landfill Tax guidance SLfT1000, n.d.

18.1.7 A detailed review of the legislative and policy framework, and an assessment of the alignment of the Preferred Route Option proposals with the regulatory and policy context would be undertaken as part of the DMRB Stage 3 assessment.

18.1.8 Reference is made to Volume 1, Part 3 - Environmental Assessment (Chapter 21: Policies and Plans), along with *Appendix A21.1 (Assessment of Policy Compliance)* which assesses compliance of the proposed route options against national to local planning policies relevant to material assets and waste at this stage.

18.2 Approach and Methods

Scope

18.2.1 For the purposes of this assessment, 'Material Assets and Waste' are defined according to guidance in the DMRB LA 110 Material assets and waste (Highways England, 2019), as comprising:

- The consumption of material assets [Article 3.1 (d) of the EIA directive]. This includes materials and products from primary, secondary, recycled and renewable sources, the use of materials offering sustainability benefits, and the use of excavated and other arisings that fall within the scope of waste exemption criteria.

- The production and disposal of waste [Annex IV of the EIA Directive]. This includes surplus materials which can become waste during the construction of the proposed route options, as well as other substances which the holder discards or intends or is required to discard.

Study Area

18.2.2 In accordance with DMRB LA 110, the assessment of material assets and waste has utilised two geographically different study areas to examine the use of material assets; and the generation and management of waste:

- The first study area is based on the construction footprint/boundary (including compounds and temporary land take) of the proposed route options. Within these areas, materials assets would be consumed, and waste would be generated.
- The second study area is based on the likely provenance of construction materials required to construct the main elements of the proposed route options, and waste infrastructure that is likely to be suitable (permitted for waste volume and type) to accept arisings and/or waste generated by the proposed route options. These include:
  - Perth & Kinross, Angus, North Fife and Dundee City Mineral Planning Areas which are likely to be the primary source of material assets (primary, secondary and recycled aggregates) used to construct the proposed route options. This study area has been delineated through the adoption of the TAYplan strategic development planning authority area.
  - Perth & Kinross, Angus, North Fife and Dundee City Council Waste Planning Areas where the waste management infrastructure, likely to be used in managing the majority of waste generated by the proposed route options, is located. This study area has also been delineated through the adoption of the TAYplan strategic development planning authority area.

18.2.3 The TAYplan covers the City-regions of Dundee and Perth and is a statutory partnership of Dundee City, Angus, Perth & Kinross and Fife Councils. The TAYplan area covers all of Dundee City, the North Part of Fife and the majority of Angus and Perth & Kinross but excludes those part covered by the Cairngorms and the Loch Lomond & Trossachs National Park Authorities.

18.2.4 In accordance with DMRB LA 110, professional judgement, with consideration for a balance of the proximity principle and value for money principle, has been applied in establishing the second study area.

Baseline conditions

18.2.5 In reporting the DMRB Stage 2 Assessment, the following baseline data has been gathered for the anticipated construction phase (2023 to 2026) and the first year of operational activities (opening year) (2026) in the absence of the proposed route options. This has been sourced from desk-based reviews of existing information, and through the analysis of stakeholder information (where available):

- a description of the study area, including information about the types and quantity of material use and waste generation associated with operation of the existing road/site;
- an assessment of the regional availability of key construction aggregates, facilitated by a review of the Scottish Aggregates Survey Report 2012 (published 2015); and the location of any mineral safeguarding sites and peat resources in relation to the proposed route options;
- an assessment of any mineral safeguarding sites and peat resources in relation to the proposed route options; and
- an assessment of the current and likely future state of regional transfer, treatment, recycling, recovery and disposal facilities to be utilised by the proposed route options, through a review of the Scottish Environment Protection Agency (SEPA) Scottish Waste Sites and Capacity Tool.

18.2.6 Impacts from the use of material assets and the production and management of waste, such as resource depletion and use of waste disposal capacity, are largely dispersed or generalised, rather than affecting specific geographically-bounded receptors.

18.2.7 In contrast to other environmental factor assessments in this DMRB Stage 2 report, this assessment does not consider impacts in terms of changes to baseline conditions, as it focuses primarily on materials import and waste export in absolute terms to facilitate a comparative assessment of the proposed route options.

Consultation

18.2.8 Volume 1, Part 3 - Environmental Assessment (Chapter 7: Overview of Environmental Assessment) provides a summary of the consultation process at DMRB Stage 2.

18.2.9 The Scottish Environment Protection Agency's (SEPA's) consultation response to the A9 Dualling Programme: Strategic Environmental Assessment (SEA) Environmental Report Addendum (Transport Scotland, 2014) requested that the Scottish Government Policy on the Control of Woodland Removal should be taken into account, and notes that the policy supports the Government's Scottish Forestry Strategy and the associated ambition to see Scotland's woodland resource increase to 25% of land area.

18.2.10 This policy and guidance would be assessed as part of the DMRB Stage 3 assessment as applicable to the scope of this factor, once the Preferred Route Option is known, and further information with regard to woodland removal is available and landscape planting mitigation developed.

Methodology

18.2.11 The DMRB Stage 2 assessment primarily focuses on the potential impacts arising from the use of material assets and the production, processing, and disposal of wastes during the construction of the proposed route options. The assessment follows the guidance as set out in DMRB LA 110.

18.2.12 Whilst DMRB LA 110 sets out the requirements for assessing and reporting the effects on material assets and waste, this standard is primarily aimed at compliance with the EIA Directive and guiding statutory EIA carried out at DMRB Stage 3 - Preliminary Design, where there is much greater certainty around the design of a proposed scheme. DMRB LA 110 does not provide a separate methodology for the options selection/preliminary design stage where it is often not possible to quantify material requirements and forecast waste generation in absolute terms.

18.2.13 A semi-quantitative assessment has therefore been undertaken, appropriate to DMRB Stage 2, with professional judgement applied to the DMRB LA 110 assessment criteria as required. The collection, interpretation and use of the following information on materials assets and waste has been targeted during the Stage 2 environmental assessment in order to generate a meaningful comparative assessment of the proposed route options presented to provide an indication of the relative magnitude of materials assets use and waste generation associated with each proposed route option:

- estimated quantities of material assets consumption;
- estimates of the number of structures to be demolished;
- estimates of the number of new structures and structures cost; and
- estimated quantities of surplus earthworks materials.

18.2.14 Estimates of material requirements and potential waste generation from the proposed route options were obtained from the three-dimensional models of the proposed route options, taking account of the re-usability of the estimated excavated material, earthworks design and pavement requirements. These estimates take account of aspects such as the alignment of the proposed route options and the consequent road cuttings and embankments that may be required, typical requirements for the length and area of roads infrastructure, and the demolition, reuse or provision of new structures such as bridges.

18.2.15 At this stage in the design, there is limited information available regarding the quantities of waste to be generated by each proposed route option, with the notable exception of surplus earthworks materials.

18.2.16 Where large quantities of material need to be disposed of off-site as a result of an imbalance between cut and fill, this represents an adverse impact. Some excavated materials, which may not be suitable for use in the construction of the road directly, could potentially be used in other aspects of construction subject to waste regulatory controls, such as the creation of landscaping or noise bunds.

18.2.17 This chapter includes materials estimates for each of the proposed route options, and where material volumes could not be estimated (e.g. for structures), the anticipated number and type or cost of structures has been taken as a proxy for the volume of material required and waste likely to be generated. As such, the values underpinning this assessment are indicative only; and based on standard assumptions, DMRB Stage 2 level of design, and ground/site information. This assessment therefore generally focusses on the differences between the proposed route options and these differences have been used for the purposes of comparative assessment. Professional engineering judgement has informed the determination of material and wastes quantities, and whether the differences between each proposed route option is considered sufficient to be a differentiator for identification of the Preferred Route Option. The DMRB LA 110 significance criteria themselves are not considered to be a useful differentiator of impacts/effects at this stage of assessment.

18.2.18 Operational impacts associated with material assets and waste have not been assessed, as they were considered to be not significant (by quantity) in the context of the proposed route options. Furthermore, DMRB LA 110 specifies that the environmental assessment should only report on the first year of operational activities (i.e. the opening year). It has been assumed that no significant maintenance activities would occur during the opening year, and therefore no significant materials consumption or waste generation is likely to be realised. Whilst it is appreciated that the first year of operational activities is a time period not necessarily confined to operational effects, any construction phase effects overlapping within this period are captured within the construction phase assessment.

18.2.19 The design process would inherently seek to minimise the consumption of material assets, unnecessary sterilisation of mineral resources, and the generation of waste throughout the lifecycle of the Preferred Route Option. Design choices and the choice of materials will make a significant contribution to reducing the environmental impacts, associated with material assets and waste during operation, by influencing the required method and frequency of maintenance, and facilitating opportunities to recover and regenerate materials and products at the end of first life to support a circular economy. It is also assumed that the assessment of any environmental impacts and effects associated with material assets and waste during any large scale future maintenance, renewal, or improvement works beyond the opening year, would be undertaken by the Road Operating Company in accordance with the requirements of the Overseeing Organisation.

18.2.20 Material consumption and waste production and management can affect the full range of environmental media and assessment factors. Where materials are consumed, and waste is generated, it is acknowledged that, depending on how they are managed, indirect adverse effects may arise (from greenhouse gas emissions; water consumption; visual impacts, dust, noise, vibration, vehicle emissions, disruption to traffic and other potential causes of nuisance; and water pollution amongst others). Such effects do not form part of the material assets and waste assessment and are considered as part of the other technical chapters in this EIAR. This chapter should therefore be read in conjunction with Volume 1, Part 3 - Environmental Assessment (Chapter 9: Geology, Soils and Groundwater, Chapter 10: Road Drainage and the Water Environment, Chapter 15: Air Quality, Chapter 16: Noise and Vibration, Chapter 17: People and Communities, Chapter 19: Climate and Chapter 20: Human Health).

Community Objectives

18.2.21 At an early stage in the A9 Co-Creative Process, the Birnam to Ballinluig A9 Community Group generated community objectives. The seven community objectives are presented in Volume 1, Part 3 - Environmental Assessment (Chapter 7: Overview of Environmental Assessment) and cover a wide range of factors but focus predominantly on environmental issues.

18.2.22 The community objectives have been taken into consideration throughout the DMRB Stage 2 process, and a mapping exercise was conducted to indicate how, in the operational phase, the proposed route options could contribute to the relevant objectives. Details of how each environmental factor contributes towards achieving the community objectives are presented in *Appendix A7.1 (Mapping of Community Objectives Against DMRB Stage 2 Route Options)* and a summary for this chapter is given in Section 18.6.

Limitations to Assessment

18.2.23 There is limited information available at this stage of the DMRB assessment regarding the following DMRB LA 110 assessment parameters:

- types and quantities of materials required for construction;
- information on materials that contain secondary/recycled content;
- information on any known sustainability credentials of materials to be consumed;
- the type and volume of materials that will be recovered from on or off-site sources;
- the cut and fill balance;
- details of on-site storage and stockpiling arrangements, and any supporting logistical details;
- the amount of waste (by weight) that will be recovered and diverted from landfill either on site or off site (i.e. for use on other projects);
- types and quantities of waste arising from construction (demolition, excavation arisings and remediation) requiring disposal to landfill;
- details of on-site storage and segregation arrangement for waste and any supporting logistical arrangements; and
- potential for generation of hazardous waste (type and quantity).

18.2.24 The assessment of the proposed options has been undertaken assuming large quantities of topsoil (typically 68 - 72%) and 90% of excavated cut material could be reused on-site. These values are informed by current knowledge of materials/ground conditions. The amounts of materials suitable for reuse would be determined by on-site observations and chemical analysis and may represent a larger or smaller percentage of the fill materials than is assumed in this assessment. It is assumed that the construction sequence for excavating material would be such that it permits reuse of excavated material within the works; however, this would be further considered at DMRB Stage 3.

18.2.25 The above limitations are typical of a DMRB Stage 2 assessment, and at this stage the assessment reported in this chapter is considered robust and of an appropriate level to provide an assessment of the proposed route options.

18.3 Baseline Conditions

18.3.1 A desk-based assessment has been undertaken in order to establish, for the first and second study areas, the current and likely future conditions for material assets and waste (in the absence of the proposed route options.

18.3.2 Baseline data has been collected at national, regional, sub-regional and local levels, including:

- availability of primary construction aggregates;
- presence of mineral safeguarding sites and/or peat resources;
- construction, demolition and excavation waste arisings; and
- information on regional waste transfer, treatment, recycling, and disposal facilities capacity.

Material Assets

18.3.3 For the purpose of this assessment, material assets are considered to be the physical resources in the environment, which may be of human or natural origin.

18.3.4 Primary aggregates have been chosen to act as a proxy indicator of material assets given that large quantities of aggregates are typically required for motorway and all-purpose trunk road projects, e.g. for direct use in unbound bulk fill, capping, sub-base, filter drains, and for indirect use in bound applications such as concrete and asphalt.

18.3.5 This was also considered appropriate due to the prominence given to aggregates in DMRB LA 110, and the fact that aggregates are likely to constitute the key construction material (by weight) required to construct the proposed route options.

Existing Aggregates Consumption

18.3.6 The operational maintenance of the existing A9 consumes both unbound aggregates (used as sub-base and drainage applications) and bound aggregates (used in ready mixed concrete, asphalt and pre-cast concrete products). At the time of writing, there were no figures available regarding the baseline quantities of operational/maintenance aggregates consumption generated across the first study area. Based on recent experience on other road schemes, this information is unlikely to be available.

Primary Aggregate Reserves

18.3.7 The principal materials used in road construction are primary aggregates, including sand, gravel and crushed rock. Primary aggregates are aggregates produced from naturally occurring mineral deposits and used for the first time, as defined by the British Geological Survey (BGS) (2019) Mineral Planning Factsheet Construction Aggregates.

18.3.8 Aggregates are normally defined as being hard, granular materials which are suitable for use either on their own or with the addition of cement, lime or a bituminous binder in construction. However, a proportion of aggregates sales are for construction fill or other uses where soft and non-granular material may be acceptable or specified.

18.3.9 BGS (2019) reports that the main use of sand and gravel is for concrete (63% of the total sand and gravel sold in Great Britain). Other uses for sand include mortar and for gravel include drainage layers or construction fill. The main use for crushed rock is as roadstone in road construction (40% of the total crushed rock sold), where it is either coated with bitumen in asphalt or used uncoated. A further 15% of crushed rock is used in concrete.

18.3.10 The Department for Environment Food and Rural Affairs (Defra, 2011) identifies primary aggregates as being at risk of future scarcity for the UK construction and civil engineering sector. Whilst there is no danger of physically running out of such resources, competition for land (frequently with environmental designation) and negative public perceptions towards mineral development can make it increasingly difficult for aggregate companies to secure permits to exploit these resources.

18.3.11 Scottish Planning Policy continues the UK landbank approach to planning for the supply of construction aggregates. This approach is intended to ensure that a stock of reserves, with planning permission, is maintained to ensure adequate supplies of minerals over a minimum ten-year period, based on current production levels. The ten-year period recognises the likely time scale between an operator deciding that there is a need for a new site and bringing the site into full production.

18.3.12 The Scottish Aggregates Survey Report 2012 (published in 2015) confirms that the study area had landbanks of approximately 25 years for crushed rock and 25 years for sand and gravel at the end of 2012 from active sites at maximum supply at 2012 production levels in years. In 2012, these areas produced a total of 1,675,000 tonnes of primary aggregates (848,000 tonnes of hard rock and 827,000 tonnes of sand and gravel).

18.3.13 This survey also confirms that 9% of the total Scottish production of hard rock and sand and gravel takes place within the study area (approximately 6% of hard rock and 19% of sand and gravel); and approximately 86% of the hard rock and 75% of the sand and gravel produced in the study area is retained in the region. These data were accurate as of the end of 2012 but are likely to have changed in the interim as new planning permissions are granted and as existing reserves are worked.

18.3.14 A review of the British Geological Survey Directory of Mines and Quarries (BGS, 2020) suggests that the mines and quarries in the study area are able to supply a wide range of materials, including but not limited to primary aggregate, concrete and asphalt products. It can reasonably be inferred that there is likely to be an adequate supply of construction aggregates available within the study area to construct the proposed route options; and policy, strategic and legislative drivers are likely to ensure that sufficient capacity is provided.

18.3.15 Both secondary and recycled aggregates can be used as alternatives to primary aggregate and have a number of benefits, including the reuse of secondary and waste materials and reducing the impact of primary extraction. Secondary aggregates are typically by-products of industrial processes. These can be sub-divided into manufactured and natural aggregates, depending on their source and can include materials such as pulverised fuel ash, ground granulated blast furnace slag, incinerator bottom ash and recycled glass. Whereas, recycled aggregates are typically derived from reprocessing inert materials previously used in construction, e.g. road planings or crushed concrete.

18.3.16 Zero Waste Scotland has previously produced a directory of suppliers of recycled aggregates who have successfully demonstrated their compliance with the WRAP Quality Protocol for the production of aggregates from inert waste (Zero Waste Scotland, undated). Table 18.1 provides details on the locations of suppliers, identified from the directory, that are within the study area and could be utilised for the proposed route options.

18.3.17 These suppliers could be utilised to provide recycled aggregates or potentially to process waste from the proposed route options. Other potential sources of alternative aggregates would be investigated as the detailed design is progressed, including opportunities to re-use site-won materials and materials from major development sites in the area.

Table 18.1: Recycled aggregate suppliers in TAYplan SDP areas (Zero Waste Scotland, 2019)

Sub-region	Address of Recycled Aggregate Supplier	Products
Perth & Kinross	Collace Quarry - Tayside Contracts, PH2 6JB	General fill; sub-base (Type 1); sub-base (Type 4); and drainage and filter bedding.
Fife	Clatchard Quarry - Breedon Aggregates Scotland Ltd, KY14 6JJ	General fill.
Dundee	Ardownie - Geddes Group, Ardownie Quarry, DD5 4HW	Sub-base (Type 1) and capping (6F5).
Angus	Walkkmill - Geddes Group, Waulkmill Quarry, DD11 4UT	Sub-base (Type 1) and capping (6F5).

18.3.18 The choice of whether to use primary or secondary aggregates, or a combination of both, would be made by the appointed Contractor after considering a combination of factors, such as source, specification, production and transport of available materials. Secondary or recycled aggregates may not always have the lowest impact on the environment and materials would be selected for this project based on a consideration of all relevant impacts.

18.3.19 The appointed Contractor would source materials for the construction of the proposed route options, and typically they would look to use local suppliers and to re-use materials on site to minimise the attendant environmental impact and cost of waste transport and support the economic well-being of the local communities in line with the proximity principle.

18.3.20 The use of such material would be controlled in accordance with the DfT (2021) Specification for Highway Works. Whilst competition regulations mean that it is not possible to prescribe specific materials sources (quarries, manufacturers, suppliers) with known recycled content based on Environmental Product Declarations that comply with EN 15804 standards.

Minerals Safeguarding Sites

18.3.21 Mineral safeguarding sites are defined by DMRB LA 110 as '*Operational extraction sites or mineral sites specifically identified/allocated in strategic planning documents as those that will be mined or extracted*'.

18.3.22 Scottish Planning Policy requires that: '*Local development plans should safeguard all workable mineral resources which are of economic or conservation value and ensure that these are not sterilised by other development;* and that *'Local Development Plans should support the maintenance of a landbank of permitted reserves for construction aggregates of at least 10 years at all times in all market areas through the identification of areas of search'.*

18.3.23 Whilst there are no records current quarrying or coal mining activity within the first study area, the historical evidence of gravel and bedrock extraction within the wider study area and recorded superficial geology, suggests there is potential for further mineral resources to be available within the study area. Further information on minerals is provided in Volume 1, Part 3 - Environmental Assessment (Chapter 9: Geology, Soils and Groundwater)

18.3.24 Review of the Perth & Kinross Council (2019) Local Development Plan 2 has not identified any designated Mineral Safeguarding Areas (MSA) or Areas of Search (AoS) within or in close proximity to the study areas. Superficial deposits, where present, are recorded as alluvium, river terrace deposits, glaciofluvial deposits and Devensian glacial till.

18.3.25 The majority of the existing A9 is underlain by glaciofluvial deposits comprising sand and gravel with local lenses of silt, clay and organic matter. Where the existing A9 is located close to the River Tay, for example at Inver, the River Tay Crossing and west of Little Dunkeld, the underlying superficial material comprises river alluvium, a silty clay which can contain layers of silt, sand, gravel and peat.

18.3.26 River terrace deposits are recorded in the west of the study area, further up slope on the edge of the floodplain, and are generally described as being comprised of sand and gravel with local lenses of silt, clay or peat. Glacial till is generally recorded on the higher ground of the valley sides and is typically composed of a wide range of poorly sorted clays, sands and gravels.

Peat Resources

18.3.27 Peat resources are defined in DMRB LA 110 as '*Existing or potential peat extraction sites*'. For the purposes of assessment, this equates to sites with an extant permission for commercial peat extraction. There are no peat resources identified within the study area.

18.3.28 No peat deposits are recorded on BGS Onshore Geoindex (BGS, 2021) within 250m of the study areas. In addition, the entire study area is classified as Class 0 (mineral soils where peatland habitats are not typically found) by the SNH Carbon and Peatland Map (2016) with a small area at Birnam, Little Dunkeld and Dunkeld classified as Class -2 (non-soil; i.e. loch, built up area, rock and scree).

18.3.29 A review of GI data indicated that peat and peaty soils was encountered within Dalpowie Plantation (ch1190), the vicinity of Ringwood (ch2000), at an A9 embankment near Birnam (ch2940) and at Ring Wood areas just south of Birnam. The peaty soils were generally encountered in the top 0.1 mbgl.

Waste Generation and Management

Existing Waste Generation

18.3.30 Waste produced during the operational maintenance of the existing A9 is likely to include asphalt planings, soft estate vegetative arisings, road sweepings, gully arisings, oil separator waste, animal by-products (roadkill) and litter. At the time of writing, there were no precise figures available regarding the baseline quantities of operational/maintenance waste generated across the first study area. Based on recent experience on other road schemes, this information is unlikely to be available.

Construction and Demolition Waste Generation

18.3.31 The construction of the proposed route options is likely to produce a range of waste types including inert, non-hazardous and hazardous (or special) wastes. The majority of wastes are assumed to be inert and non-hazardous Construction and Demolition (C&D) wastes. However, there will also be Municipal Solid Waste (MSW) generated by construction workers (e.g. canteen, office and staff welfare waste), and small quantities of hazardous waste (e.g. paints and solvents, admixtures, spill absorbent materials, waste lubricants, waste electrical and electronic equipment and batteries).

18.3.32 Scotland's Environment (2020) Waste Discover Data tool provides a break-down of all waste types for 2011 to 2018, and the trend for Scottish waste landfilled since 2005. This tool records that Scotland generated approximately 5.81 million tonnes of C&D waste in 2018 (an increase of 3.9% from 2017), the composition of which is detailed in Table 18.2. No regional or sub-regional breakdown is provided.

18.3.33 The tool also confirmed that 97% of C&D waste was recorded as having been prepared for reuse or recycled in 2018, against the UK target of 70% by 2020. C&D recycling rates are from data provided to Europe for reporting under the Waste Framework Directive. C&D recycling excludes hazardous waste and naturally occurring soil and stones coded under 17 05 04 of the European Waste Catalogue (or List of Wastes) provided in SEPA *et al* (2015).

Table 18.2: Generated C&D Waste from All Sources in 2018

Waste type	C&D waste generated in 2018 (tonnes)	% composition in 2018
Dredging spoils	94,925	1.63
Glass wastes	378	0.01
Metallic wastes, ferrous	149,731	2.58
Metallic wastes, mixed ferrous and non-ferrous	38,094	0.66
Metallic wastes, non-ferrous	16,969	0.29
Mineral waste from construction and demolition*	1,201,295	20.68
Other mineral wastes	23,784	0.41
Plastic wastes	5,902	0.10
Soils	4,248,335	73.14
Wood wastes	29,268	0.50
Total	**5,808,681**	**100%**

*Includes concrete, bricks and gypsum waste; bituminous and tar bound road-surfacing waste; and certain mixed C&D streams.

18.3.34 The summary document and commentary text to the tool confirms that the change in C&D waste generated year on year since 2011 has varied considerably, with year on year changes in this waste stream ranging from -26.9% to +26.1%. The generation of C&D waste is sensitive to large regional projects, which accounts for the large year annual variation in C&D waste generated.

Current Waste Treatment, Recycling and Recovery Baseline

18.3.35 The available waste treatment, recycling, recovery and disposal infrastructure within the study area accepting inert, non-hazardous and hazardous commercial and industrial waste (including C&D waste) is summarised in Table 18.3, based on a review of Scotland's Waste Sites and Capacities Tool (SEPA, 2021).

18.3.36 A number of the waste facilities identified in Table 18.3 operate more than one waste management activity on-site and it includes both merchant and restricted facilities. The reported tonnages therefore represent the total wastes inputted to each facility type and not tonnages per activity. Similarly, the reported capacities are for the facility type as a whole, not per activity as this data are not currently published by SEPA.

Table 18.3: Permitted and Remaining Capacity in Operational Waste Sites in the TAYplan Area, 2019

Waste Management Facility Type	Annual Waste Capacity (Tonnes)	Annual Waste Inputs (in 2019)	Utilised Capacity (%) (in 2019)
Civic amenity	290,912	131,420	45
Civic amenity/Transfer station	188,053	85,534	45
Civic amenity/Transfer station/Landfill (not operational)	7,000	7,871	112
Composting/Anaerobic digestion	97,620	56,267	58
Composting/Landfill (not operational)	37,000	20,742	56
Incineration	150,000	102,818	69
Landfill	586,998	83,346	14
Landfill/Civic amenity/Composting/ Other treatment	302,500	197,068	65

Waste Management Facility Type	Annual Waste Capacity (Tonnes)	Annual Waste Inputs (in 2019)	Utilised Capacity (%) (in 2019)
Landfill/Composting	165,000	20,353	12
Metal recycler	254,994	27,154	11
Metal recycler/Transfer station	52,450	24,248	46
Other treatment	135,000	51,807	38
Transfer station	724,381	255,378	35
Transfer station/Composting	175,000	102,411	59
Transfer station/Landfill (not operational)	2,499	1,790	72
Transfer station/Other treatment	229,500	104,432	46
Total capacity and inputs, and average utilised capacity in 2019	**3,398,907**	**1,272,637**	**49**

18.3.37 There was a total of 72 operational waste sites in the study area (27 in the Perth & Kinross Council area, 23 in the Angus Council area, 7 in the Northern Fife area and 15 in the Dundee City Council area) at the end of 2019. On the basis of the above facility types, throughputs and capacities, it can be assumed that there will be significant opportunity for appropriate wastes arising during the construction of the proposed route options to be reused, recycled or subject to other recovery via appropriate means, subject to the waste hierarchy of prevention, prepare for reuse, recycle, recover and dispose.

Current Landfill Capacity Baseline

18.3.38 For wastes which cannot be reused, recycled or otherwise recovered, disposal to landfill would be required. Scotland's Waste Sites and Capacities Tool (SEPA, 2021) details total remaining inert and non-hazardous landfill capacity in the study area in 2019 and is presented in Table 18.4.

18.3.39 Whilst there are no hazardous waste landfill sites present in the study area, those non-hazardous landfill sites identified in this table are also licensed to accept stable non-reactive hazardous waste in separate dedicated landfill cells (e.g. asbestos containing materials).

Table 18.4: Permitted and Remaining Capacity of Operational Landfills (Inert and Non-Hazardous) in the TAYplan Area, 2019

Site Name	Council Area	Distance from Study Area	Capacity on Permit 2019 (t)		Remaining Capacity at the End of 2019 (t)		
			Annual	Total	Total landfilled in 2019 (t)	Remaining Capacity (t)	Estimated Date for Ceasing Landfill
Inert landfill sites							
D Geddes Ltd, Border Quarry LF, Friockheim	Angus	~70km	24999	-	664	344,626	01/12/2050
D Geddes Ltd, Ardownie Landfill, Monifieth	Angus	~60 m	75000	-	49,330	1,066,869	01/12/2035
D Geddes (Con) Ltd, Prettycur Landfill,Forfar	Angus	~50km	24999	53,067	1,942	13,058	01/12/2023

Site Name	Council Area	Distance from Study Area	Capacity on Permit 2019 (t)		Remaining Capacity at the End of 2019 (t)		
			Annual	Total	Total landfilled in 2019 (t)	Remaining Capacity (t)	Estimated Date for Ceasing Landfill
Tayside Contracts, Bolshan Quarry LF,Friockheim	Angus	~70km	15000	135,000	2,665	86,180	01/11/2034
Hatton Mill Landfil site	Angus	~70km	75000	1,875,270	12,315	1,857,379	01/12/2034
Non-hazardous landfill sites+							
Fife Council, Lower Melville Woods, Fife	Fife	~60km	282500	2,701,000	108,948	234,400	01/12/2022
Total	**N/A**	**N/A**	**497,498**	**4,764,337**	**175,864**	**3,602,512**	**N/A**
+ These non-hazardous landfills also accept stable non-reactive hazardous waste (e.g. asbestos containing materials).							

18.3.40 The baseline review suggests that there is currently available inert landfill capacity within the study area for the majority of wastes likely to arise from the construction of the proposed route options, but there is limited non-hazardous and no hazardous waste disposal capacity. The closest operational non-hazardous and hazardous landfills, with remaining capacity at the end of 2019, being:

- Lochhead landfill, By Wellwood, Fife (~70km), with 432,800 t of remaining non-hazardous landfill capacity, and an estimated date for ceasing landfill of 01/01/2023;
- Avondale Non-Hazardous Landfill, Polmont, Falkirk (~100km), with 1,197,000 t of remaining non-hazardous landfill capacity, and an estimated date of ceasing landfill of 01/03/2022;
- West Carron Landfill, Stenhouse Rd, Falkirk (~100km), with 305,000 t of remaining non-hazardous landfill capacity, and an estimated date of ceasing landfill of 01/12/2027;
- Greengairs L/F, Meikle Drumgray Rd, Airdrie (~100km), with 11,181,872 t of remaining non-hazardous landfill capacity, and an estimated date of ceasing landfill of 01/05/2038; and
- Avondale Environmental Landfill, Polmont, Falkirk (~100km), with 59,180 t of remaining hazardous capacity, and an estimated date for ceasing landfill of 01/01/2023. This is Scotland's only hazardous waste landfill site.

18.3.41 These landfill sites are considered to be outwith the study area for the purposes of assessment based on the proximity principle and value for money principles. Based on data provided in Scotland's Waste Sites and Capacities Tool (SEPA, 2021), all but West Carron landfill and Greengairs landfill are predicted to have ceased infilling by the start of construction in 2023.

18.3.42 Some non-hazardous landfills in Scotland may also accept stable non-reactive hazardous waste (SNRHW) material into a dedicated cell (e.g. asbestos containing materials), but this is usually a small part of the overall capacity of the site.

Future Waste Treatment, Recycling and Recovery Baseline

18.3.43 Waste treatment, recycling and recovery infrastructure facilities are considered to be a beneficiary of incoming materials through driving the management of up the waste hierarchy, and by creating conditions that facilitate a circular approach to the management of materials.

18.3.44 These facilities are therefore not considered to be sensitive receptors for the purposes of assessment in the same way as landfill sites given that they are part of a recovery system that has the potential to reduce the environmental effects associated with waste generation, management and disposal. These facilities are also different to landfills, in that landfills are a finite resource.

18.3.45 Waste treatment, recycling and recovery facilities are typically characterised by large annual throughputs; consequently, large step changes in capacity (as single facilities are commissioned) have an exaggerated impact on the historical trend. Waste treatment, recycling and recovery infrastructure capacity cannot therefore be realistically projected forward to the construction phase of the proposed route options.

18.3.46 Professional experience has shown that waste markets are flexible and adapt to changing markets within a region; and that historical trends show that waste treatment, recycling and recovery is added or removed, not least to cope with changes in waste generation. It is expected that whilst the actual waste facilities available may change over the course of constructing the proposed route options, the overall capacity is likely to remain similar as the market responds.

18.3.47 The future waste treatment and recovery infrastructure capacity for use in the assessment will, therefore, be based on the most recent available SEPA annual capacity/input data for 2019. This suggests that there is likely to be adequate opportunity for wastes arising during the construction of the proposed route options to be treated, recycled or otherwise recovered via appropriate means within the study area.

Future Forecast Inert Landfill Capacity

18.3.48 Projected future landfill capacity values have been estimated and illustrated in Table 18.5 and Diagram 18.1 respectively based on the average annual percentage change in remaining (total) inert landfill capacity for the years for which consistent data are available from SEPA (i.e. 2015 to 2019).

18.3.49 The predicted changes in landfill capacity are derived from the existing SEPA time-based data (remaining landfill capacity at the end of each calendar year). These data have been projected forward to the 2026 opening year for the proposed route options, using the Exponential Smoothing algorithm in Microsoft Excel (Microsoft, n.d.), in order to provide a statistical estimate the remaining landfill capacity that may be available during the proposed construction phase (between 2023 and 2026).

18.3.50 This estimate assumes continuation of a similar trend in the addition and subtraction of operational landfill capacity as that reported by SEPA for the period 2015 to 2019.

Table 18.5: Forecast Future Inert Landfill Capacity in the Study Area (2020 to 2026)

Timeline	Forecast Future Baseline Capacity (t)	Lower Confidence Bound Capacity (t)	Upper Confidence Bound Capacity (t)
2020	3,348,136	3,332,287	3,363,985
2021	3,320,605	3,302,871	3,338,339
2022	3,297,406	3,277,956	3,316,856
2023	3,269,874	3,248,848	3,290,901
2024	3,246,676	3,224,172	3,269,179
2025	3,219,144	3,195,254	3,243,034
2026	3,195,945	3,170,735	3,221,156
Average capacity 2023-2026 (tpa)	**3,232,910**	**3,209,752**	**3,256,068**

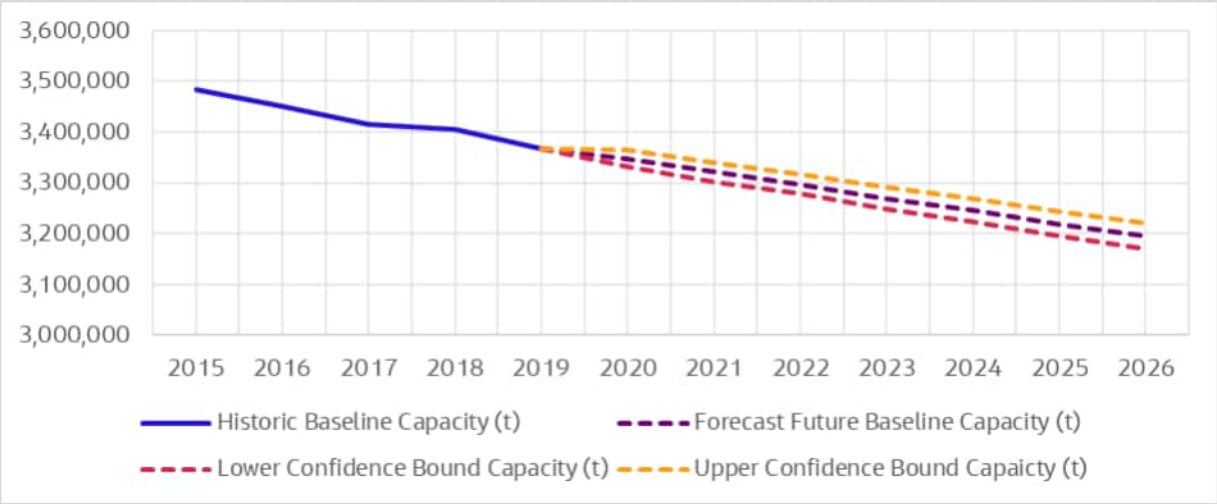

Diagram 18.1: Forecast Future Inert Landfill Capacity in the Study Area (2020 to 2026)

18.3.51 Although there is a generally a reducing trend for landfill disposal in Scotland, the forecast future baseline landfill capacity suggests that there is likely to be adequate inert landfill capacity available in the study area on average between 2023 and 2026 to support the construction of the proposed route options (~3,232,910 tpa). This means that any inert waste that is destined for landfill would most likely find capacity in the study area.

18.3.52 The only non-hazardous landfill in the study area (Lower Melville Woods Landfill) is likely to have ceased infilling by January 2022 and it has therefore been assumed that no non-hazardous landfill capacity is likely to be available in the study area at the start of the construction period unless existing landfills are extended, or new landfills are constructed.

18.3.53 Scotland is also likely to have exhausted all remaining hazardous landfill capacity by start of 2023. Discussions with the site operator (Solczak, 2020) confirms that Avondale is in the process of submitting an application to SEPA for the licensing/permitting of an additional 400,000m^3 of hazardous waste landfill capacity at its Polmont site. It is not known if this application will be approved by SEPA or when any additional capacity would become available.

18.3.54 Should this additional capacity at Polmont not be realised, Scotland would need to authorise the construction of additional hazardous landfill capacity to replace this deficit or consign this waste to landfills in located in England. Reference to the Environment Agency (2020) Waste Data Tables 2019 for the North West and North East of England would suggest that these regions had an abundance (6,000,084m^3 and 6,852,446m^3 respectively) of merchant hazardous waste landfill capacity at the end of 2019. Existing capacity is located in the Cheshire, Lancashire, Merseyside and Tees Valley sub-regions.

18.3.55 It is envisaged that the vast majority of the inert and non-hazardous waste arising from constructing the proposed route options would be re-used, recycled or recovered as appropriate in accordance with the legislative and policy regime. This will be required to comply with the legislative and policy framework for waste, and to minimise the attendant environmental impact and cost of waste transport and disposal in accordance with the proximity principal.

18.3.56 This assumption is validated by the available Scottish statistics with 97% of C&D waste having been diverted from landfill in 2018. Diversion of waste from landfill will also be required in order to demonstrate the Preferred Route Option's contribution to achieving Scotland's Zero Waste Plan target of recycling 70% of all waste, and landfilling a maximum of 5% by 2025; and to comply with the provisions of The Waste (Scotland) Regulations 2011 (e.g. taking all such reasonable measures available to apply the waste hierarchy) and The Waste (Scotland) Regulations 2012 (e.g. banning the landfilling of segregated waste).

18.3.57 Furthermore, under the Landfill (Scotland) Regulations 2003, waste can also only be disposed of to landfill after prior treatment unless it is inert waste for which treatment is not technically feasible or it is waste other than inert waste and treatment would not reduce its quantity or the hazards which it poses to human health or the environment. Treatment means any physical, thermal, chemical or biological processes (including sorting) that changes the characteristics of waste in order to reduce its volume or hazardous nature, facilitate its handling or enhance recovery.

18.3.58 It is also of note that even where wastes are accepted at landfill, some inert and non-hazardous wastes may, subject to their properties, be suitable for reuse, recycling or recovery within landfill cover or other engineering rather than subject to and accounted as disposal. Any landfills that have ceased infilling, at the time of construction, and are no longer accepting waste may also still require inert and non-hazardous materials for capping and restoration purposes, and therefore may be amenable to accepting any suitable surplus materials arising from construction subject to waste regulatory controls (e.g. waste management licensing, pollution prevention and control permitting or exemptions).

Sensitivity of the Identified Resources and Receptors

18.3.59 The baseline environment is comprised of receptors which have been defined geographically based on the likely impacts and effects, associated with the use and consumption of material assets and the production and management of waste, as set out in DMRB LA 110.

18.3.60 Whilst these receptors and an indication of their sensitivity are summarised in Table 18.6, it should be noted that the DMRB LA 110 simplified significance framework precludes the need to assign a sensitivity rating to the identified receptors for the purposes of assessment.

Table 18.6: Sensitivity of receptors that are relevant to the materials assets and waste factor

Receptor	Sensitivity of the Receptor
Primary, secondary and recycled aggregate resources	There is likely to be a good supply of both primary and recycled aggregates within the study area to construct the proposed route options. Although, there is currently limited information on the availability of secondary aggregates.
Mineral safeguarding sites and peat resources	There are no 'Mineral Sites' or 'Peat Resources' within or in close proximity to the first study area. It is therefore proposed that this sub-element be scoped out of the material assets element of the assessment going forward.
Waste management infrastructure	There is likely to be adequate waste management capacity within the study area to accommodate the majority of wastes arising from the construction of the proposed route options, and there is unlikely to be any specific constraints with regards to managing inert waste streams. However, there is not anticipated to be any non-hazardous landfill capacity remaining the study area in 2023; and Scotland's sole hazardous waste landfill, located outwith the study area, is expected to have exhausted all remaining capacity by 2021.

18.3.61 DMRB LA 110 requires that sensitive receptors (designated sites identified in other environmental factors) should also be considered in order to minimise the effects from material assets and waste. In addition to the generalised receptors identified in Table 18.6 for material assets and waste, further environmental receptors and designated sites are considered in the other chapters in this report.

18.4 Potential Impacts and Effects

18.4.1 Constructing the proposed route options would require the use of large quantities of material assets which impacts upon their immediate and (in the case of primary aggregates) long-term availability; this results in the depletion of natural resources, resulting in the temporary or permanent adverse effects on the natural environment.

18.4.2 Material assets include both primary materials, such as mineral aggregates, and manufactured construction products such and asphalt and concrete. Some of these materials would originate off site, purchased as primary construction products, but it is likely that some would arise onsite, particularly from the use excavated soils, crushed concrete or recycled asphalt planings, or recycled materials brought in from off site, possibly from other projects or industries.

18.4.3 Constructing the proposed route options would also result in large quantities of surplus materials and waste, leading to potential impacts and effects on the available waste management infrastructure through permanently occupying landfill capacity. Landfill is a finite resource, and through the ongoing disposal of waste there is a continued need to expand existing and develop new landfill facilities. This loss of resources to landfill requires the extraction and/or production of new material assets which, in turn, accelerates the depletion of natural resources resulting in temporary or permanent adverse effects on the natural environment.

Construction

18.4.4 As is normal at this stage of the assessment process, the DMRB Stage 2 proposed route option designs do not contain detailed design information for the proposed route options. Consequently, there was limited information available at the time of assessment on the types and quantities of materials required or wastes arising from the project (e.g. in the form of a detailed Bill of Quantities). Based on experience and as is common for a road of this type, the materials used and wastes generated, are likely to include those identified in Table 18.7.

Table 18.7: Likely materials assets use and waste generation

Project Activity	Material Assets Use	Waste Arisings	Additional information on Material assets or Waste Arisings
Site remediation/ preparation; Demolition; Site construction	▪ General fill and landscaping fill ▪ Capping materials ▪ Bituminous materials for road pavement construction ▪ Road markings (thermoplastic materials) ▪ Granular stone sub base ▪ Drainage products – pipes, chambers and gully pots (including metal covers or grates), plastic or precast concrete ▪ Drainage products – geocellular/modular storage systems and interceptors (likely to be plastic) ▪ Granular stone bedding and backfill to drainage pipes ▪ Traffic signs ▪ Steel road restraint systems ▪ Steel for use in structures ▪ Precast concrete – kerbs	▪ Vegetation, tree and scrub removal (non-hazardous) ▪ Surplus earthworks materials, and peat (hazardous, non-hazardous or inert) ▪ Bituminous road planings (hazardous (if containing road tar) or non-hazardous) ▪ Steel safety barrier (non-hazardous) ▪ Concrete waste (inert) ▪ Traffic signs (non-hazardous) ▪ Street lighting columns, lanterns (non-hazardous) ▪ Cats eyes (non-hazardous) ▪ Mixed inert waste ▪ Mixed construction and demolition waste (non-hazardous) ▪ Canteen/office/ad hoc waste (non-hazardous) ▪ Mixed packaging (non-hazardous) ▪ Virgin and non-virgin timber (non-hazardous) ▪ Plastics (non-hazardous)	At this stage in the project, there is little additional information available on the materials required or wastes arising from the project.

Project Activity	Material Assets Use	Waste Arisings	Additional information on Material assets or Waste Arisings
	▪ Concrete for various purposes including drainage, sign foundations, in situ drainage channels and structures ▪ Timber (e.g. formwork, falsework) ▪ Traffic signal posts, cables, ducts, chambers.	▪ Metals (non-hazardous) ▪ Miscellaneous aqueous liquids wastes (non-hazardous) ▪ Miscellaneous hazardous waste ▪ Hydraulic oils (hazardous) ▪ Waste electrical and electronic equipment (hazardous or non-hazardous).	

Imported Materials

Earthworks and Pavement

18.4.5 The types of materials likely to be required for construction are generally the same for all road schemes. The approximate quantities of the major materials required to be brought to the site for construction for each proposed route option are provided in Table 18.8.

18.4.6 This is not an exhaustive list but represents the key bulk materials relevant to the assessment at DMRB Stage 2, which could potentially enable differentiation between the proposed route options. The material quantities below include topsoil, rock and pavement materials in addition to the estimated cut and fill volumes.

Table 18.8: Estimates of material volumes (m^3)

Proposed Route Option	Earthworks						New pavement (Import)	Total waste*
	Topsoil strip		Cut material		Total fill required on-site	Surplus + /Deficit -		
	Total excavated	Total reused on-site	Total excavated	Reused as fill on-site (90%)				
Option ST2A	148,000	108,000	1,409,000	1,268,100	751,000	517,100	118,000	698,000
Option ST2B	143,000	100,000	1,012,000	910,800	700,000	210,800	120,000	355,000
Option ST2C	144,000	100,000	1,018,000	916,200	1,203,000	-286,800	125,000	145,800
Option ST2D	141,000	96,000	865,000	778,500	747,000	31,500	120,000	163,000

Note: * Total waste for Option ST2A, ST2B and ST2D = (Total excavated topsoil + total excavated cut) – (Total reused topsoil + total fill required). This includes surplus acceptable materials that could potentially be reused, recycled or recovered off-site. Due to a material deficit in Option ST2C, total 'waste' is calculated as = (Total excavated topsoil – total topsoil reused on-site) + (total excavated cut – cut reused as fill (90%)).

18.4.7 The depletion of finite natural resources could occur through extraction of primary aggregates (e.g. sands, gravels and crushed rock) from quarries.

18.4.8 Existing soils, structures to be demolished, and other demolition materials are considered to be potential material assets, including the following which would be generated during construction:

- Excavated natural soils and/or rocks (and made ground) produced during topsoil stripping and the construction of cuttings and embankments. Excavated material could be reused on-site to form embankments (once at engineering specification), for landscaping or, potentially, used on construction projects off-site. The remaining and least preferred option would be for the material to be removed off-site for recycling, other recovery or disposal in landfill sites.
- Road planings, which could either be incorporated into new pavements as replacement aggregate (on or off-site) or used as embankment fill.

18.4.9 The Preferred Route Option would seek to achieve a 'cut and fill balance' as far as practicable, such that the amount of useable cut material produced from construction is offset by the amount of material required to build embankments and landscaping. However, not all excavated materials can be reused, either because some of it is not of suitable quality, or because there is an excess of materials of certain types. Therefore, as illustrated by the estimated earthworks quantities for construction provided in Table 18.8 additional materials would be imported and excess, unusable, materials exported.

18.4.10 For all proposed route options, the earthworks volumes assume that 90% of the excavated material (referred to in Table 18.8 as 'Cut') would be reusable on-site. Table 18.8 indicates that Option ST2C would require net import of material. In contrast, Options ST2A, ST2B and ST2D are anticipated to result in a surplus of fill materials. Approximately 286,800m^3 of material earthworks would be imported for Option ST2C and by contrast Options ST2A, ST2B and ST2D would generate a surplus of acceptable earthworks material. This could provide suitable fill material (for either on-site reuse or off-site reuse, recycling or other recovery) providing this could be processed to the necessary engineering specification or waste acceptance criteria. Options ST2A, ST2B and ST2D would require similar volumes of imported new pavement material, with Options ST2A, ST2B and ST2D varying from 118,000m^3 to 120,000m^3, and Option ST2C requiring 125,000m^3 as reported in Table 18.8.

Structures

18.4.11 Material assets are required for the construction of structures (e.g. bridges and culverts, pedestrian and vehicle underpasses and tunnels) associated with the proposed route options. Estimates of the quantities of materials for structures (such as concrete, reinforced steel) are not available at this stage of design development. However, the estimated comparative costs of the structures and the number of each type of structure for each proposed route option are available and have been considered in this assessment.

18.4.12 It would be expected that the proposed route options with the highest comparative structure costs and the greatest number of new structures would generally correlate with the greatest quantities of material requirements. The estimated comparative structure costs for each proposed route option and the number of each structure type are provided in Table 18.9.

Table 18.9: Estimated cost of structures and number of each structure type

Proposed Route option	Comparative estimated cost of structures*	No. of bridges	No. of culverts	No. of retaining walls	No. of tunnels	No. of underpasses
Option ST2A	360%	7	2	2	1**	0
Option ST2B	130%	8	2	2	0	1***
Option ST2C	150%	9	1	5	0	1****
Option ST2D	100%	9	1	2	0	1****

* Estimated structure costs presented as comparative values. The lowest cost option is assigned 100%, and the remaining options are expressed as a percentage of this (i.e. 110% would be 10% more expensive than the lowest cost option).
** Cut and cover tunnel length is approximately 1.5km
*** Underpass length is approximately 150m
**** Pedestrian underpass only

18.4.13 Table 18.9 indicates a variation between 100% and 360% in comparative estimated structure costs. Option ST2D has the lowest estimated costs and Option ST2A the highest. The higher costs are linked to the number and scale of proposed structures, which require greater quantities of materials (and potentially result in a greater amount of waste):

- Option ST2A includes a 1.5km cut and cover tunnel, which would require additional resources and materials to construct, in comparison to the other options associated with the installation of approximately 3,700 piles and use of 430,000 tonnes of concrete.
- Option ST2C has the greatest number of retaining walls (five), whereas all other proposed route options have only two retaining walls. There are small variations in the number of bridges (varying between seven and nine) and culverts (varying between one and two).
- Option ST2B includes a 150m underpass for the main alignment, which is a key structure for this proposed route option that would require additional construction materials such as the installation of approximately 860 piles and use of 58,000 tonnes of concrete. Options ST2C and ST2D include one pedestrian underpass.

Waste Arisings

18.4.14 For wastes and surplus or defective materials, the potential impacts would be primarily associated with the production, movement, transport and processing (including recycling/recovery) of wastes and, if required, their disposal at authorised landfill sites.

18.4.15 The following wastes are likely to require removal from site for all proposed route options:

- soils and earthworks materials;
- bituminous road planings, including those containing coal tars;
- concrete;
- metals and plastics;
- peat, wood and vegetation wastes; and
- general waste and office waste.

18.4.16 Existing soils, structures and infrastructure removed during the construction works are likely to be considered as waste if there is no possibility of reusing the materials in new construction (on or off-site). If treatment is required in order to render the material suitable for re-use, the material is often likely to be considered waste.

18.4.17 However, the material may alternatively cease to be waste once treated by biological, chemical, physical or any combination of these and would typically require an appropriate Environmental Permit or Waste Exemption Licence to be obtained from SEPA.

18.4.18 Where direct reuse is not possible on or off-site, the material would need to be appropriately recycled, recovered or disposed of and would again be classified as waste. As reported in paragraph 18.3.51, there is potential inert landfill capacity across the TAYplan region. However, there is unlikely to be any available non-hazardous or hazardous landfill capacity in the study area at the time of construction.

18.4.19 Option ST2A, and to a lesser extent ST2B, would involve extensive construction works, with on-site concrete batching to satisfy the concrete production demand along with an on-site mud plant to support the piling works. These activities are likely to result in the generation of waste.

18.4.20 It is assumed the majority of other wastes, if appropriate, would be returned to a manufacturer to be reused or would be transported to appropriately licenced recycling/reprocessing facilities to be recovered. A proportion of the general and office wastes may require disposal to landfill. Disposal of waste will comply with all waste regulatory controls.

Earthworks Materials Surplus/Disposal

18.4.21 All proposed route options require the removal of surplus excavated materials (which includes surplus topsoil) (labelled as 'Total 'waste' in Table 18.8) that are potentially unsuitable for reuse on-site as engineering fill and/or due to there being a surplus in terms of the amount of fill required. Any surplus materials may therefore become waste if subsequently 'discarded' within the meaning of the definition provided in paragraph 18.2.1.

18.4.22 Table 18.8 indicates that Option ST2A would require the highest level of 'total waste' removal at approximately 698,000m^3 due to the high levels of material required to be excavated. Option ST2C would require the lowest level of 'total waste' removal at approximately 145,800m^3. Based on the information provided in Table 18.8, Option ST2A would require removal of over four times more material than is anticipated for Option ST2C.

18.4.23 Some of the excavated materials and surplus topsoil may be suitable for reuse, recycling or other recovery off-site rather than disposal at landfill. This scenario would be based on a number of factors such as: demand/market for the surplus material; the surplus material meeting the required specification or acceptance criteria; and appropriate treatments/procedures in place with the relevant environmental compliance and/or waste management licenses.

18.4.24 Should it not be possible to reuse, recycle or recover excavated material off-site, then this would result in landfilling of between 145,800m^3 (Option ST2C) to 698,000m^3 (Option ST2A) of material[1]. This equates to utilising approximately 7% to 32% of the average inert landfill capacity forecast to be available between 2023 and 2026 in the study area. It is recognised that this is a highly conservative assessment scenario, and it is likely that a significant proportion of this material would be diverted from landfill through off-site reuse, recycling or other recovery methods.

18.4.25 The most recent SEPA (2020a) statistics confirms that approximately 67% of total soils, from all sources, were diverted from landfill during the 2018 reporting year. If this recovery rate were to be applied to the proposed options, then this would result in the landfilling of between 48,100m^3 (Option ST2C) to 230,300m^3 (Option ST2A) of material. This equates to utilising approximately 2% to 11% of the average inert landfill capacity likely to be between 2023 and 2026 in the study area. It is again recognised that this is a highly conservative assessment scenario, and it is likely that a higher proportion of this material would be diverted from landfill through.

Waste Arisings from Demolition

18.4.26 Table 18.10 below shows the total number of residential and commercial properties that require demolition. Option ST2B requires five buildings to be demolished, whereas Options ST2A, ST2C and ST2D would require seven buildings to be demolished. See Chapter 8 (Population: Land Use) for further details of the properties to be demolished.

[1] Landfill capacity is provided in tonnes by SEPA (2021). These volumes were converted to an equivalent tonnage figure through the use of the standard density convention factors of 1.5t/m^3 for inert waste.

Table 18.10: Demolition information for each option

Property reference	Category	Option ST2A	Option ST2B	Option ST2C	Option ST2D
Foster Contracting (North) Ltd (area also sub-let to Dunkeld Builders)	Commercial and residential	✔ ✔ ✔	✔ ✔ ✔	✔ ✔ ✔	✔ ✔ ✔
Auchlou Cottage	Residential	✔	✔	✔	✔
Aran's Bakery	Commercial	✔	✔	✔	✔
Birnam Industrial Estate (including Lonely Mountain Skis and Merriman Joinery)	Commercial	✔ ✔	X X	✔ ✔	✔ ✔
Total (number of buildings)	**N/A**	**7**	**5**	**7**	**7**

18.4.27 At this stage it is not possible to accurately quantify how much waste would be generated for each proposed route option through the demolition activities, therefore for the purposes of comparative assessment similar amounts of waste generated per demolition has been assumed.

Hazardous Wastes

18.4.28 Some types of waste are harmful to human health, or to the environment, either immediately or following exposure over an extended period of time. These are called hazardous (or special) wastes. Hazardous wastes may comprise of any contaminated soils that cannot be treated to make them suitable for use, such as any material contaminated with asbestos or volatile organic compounds.

18.4.29 The likelihood of the project to intercept with contaminated land sites is discussed in Volume 1, Part 3 – Environmental Assessment (Chapter 9: Geology, Soils and Groundwater). Whilst the proposed route options are anticipated to have direct interaction with between seven to ten potentially contaminated sites, any variation between options is considered to be negligible.

18.4.30 Although the quantities of any potentially hazardous waste to be generated cannot be determined at this stage, identification of sites provides an indication of likely sources of waste to be generated by the proposed route options. It should be noted that at this stage the sites identified are only potentially contaminated and therefore may not generate hazardous waste.

18.4.31 Where contaminated materials encountered on-site are not suitable for reuse, it may be possible in some cases to carry out treatment on-site to make them suitable for reuse (refer to SEPA 'Land remediation and waste management guidelines').

18.5 Potential Mitigation

18.5.1 Measures will be implemented to minimise the potential impacts and effects associated with both the consumption of material assets and the production and management of wastes during the construction of the Preferred Route Option. There is significant synergy between material assets and waste, thus, there is overlap between the mitigation measures.

18.5.2 At DMRB Stage 2, the proposed route option designs have not been sufficiently developed to allow mitigation measures to be defined in detail. This section therefore identifies 'anticipated' mitigation taking into account legislation, policy, best practice guidance and standard mitigation measures that have been developed for the A9 Dualling Programme. This outline would be developed and refined further during the DMRB Stage 3 assessment as required.

18.5.3 Such measures would support the delivery of the A9 Sustainability Strategy objective of *'optimising resource efficiency across the life of the A9 Dualling Programme, with particular regard to geographical scale and project alignment'* through:

- complying with all relevant legislation, policy and plans pertaining to the use of material assets and the management of waste; and take cognisance of all relevant SEPA definition of waste guidance, end-of-waste guidance, special waste guidance, statutory guidance and position statements;
- Designing for Resource Efficient (DfRE) construction in order to make the best use of materials and minimise waste generation and disposal to landfill.
- responsibly sourcing construction materials and products, and investigating alternatives to the use of primary aggregates; and
- designing out waste and facilitating the prevention, reuse, recycling and other recovery of Construction, Demolition and Excavation (CD&E) waste through the implementation of a Site Waste Management Plan (SWMP).

18.5.4 The Contractor would be required to develop a management system to structure the implementation of the mitigation measures outlined in this and other chapters of the Environmental Statement. This would include a Construction Environmental Management Plan (CEMP), requirements for which would be established via the Contract Documents.

18.5.5 The CEMP would capture and collate all available information relating to the scheme specific environmental objectives, environmental risks, proposed mitigation and commitments that would need to be addressed in the delivery of the project; this would be achieved by transposing these requirements into a series of clear environmental actions to ensure that each action is fully considered during the construction stage. It is anticipated that the CEMP would include the following:

- Details of the approach to environmental management throughout the construction phase, with the primary aim of mitigating any adverse impacts and effects from construction activity on the identified sensitive receptors.
- Methods for the prevention and control of any potential short-term construction-phase impacts (e.g. construction dust and the risk of accidental spillages of contaminating materials) and also permanent effects (e.g. disturbance to vegetation, archaeology and heritage).
- Good materials management methods, such as co-location of temporary haul routes on permanent capping where appropriate, and recovery and reuse of temporary works materials from haul routes, plant and piling mattresses, etc.
- Specific method statements and strategic details of how relevant environmental risks/impacts would be addressed throughout the proposed route options, embodying the requirements of the relevant SEPA Pollution Prevention Guidelines (including PPG 6: Working at construction and demolition sites) and subsequent guidance series, Guidance for Pollution Prevention (GPP's).

18.5.6 A detailed description of the standard mitigation measures is provided below and in Table 18.11. These measures would be secured through contractual responsibilities between Transport Scotland and its design and construction contractors, and implemented, measured and monitored during construction using a variety of methods including, but not limited to:

- contract documents;

- CEMP;
- SWMP;
- materials management plans (where required);
- materials procurement register/invoices/certifications records; and
- weighbridge records/waste transfer notes/consignment notes.

Construction

Comply with All Relevant Legislation, Policy and Plans

18.5.7 The use and consumption of material assets and the production and management of waste are subject to a complex framework of legislative and policy instruments at the National, Local and Client levels. In addition to material and waste-specific policies, legislation and guidance, there is also the legislative framework for sustainable development which must be considered in assessing the environmental impacts and effects of material resource use and waste management associated with constructing the project.

18.5.8 The Contractor shall comply with all relevant material and waste specific legislation, policies and plans, including but not limited to those identified in Volume 1, Part 3 - Environmental Assessment (Chapter 19: Policies and Plans), along with *Appendices A19.1: Assessment of Policy Compliance*. Furthermore, the Contactor shall take cognisance of all relevant SEPA definition of waste guidance, end-of-waste guidance, special waste guidance, statutory guidance and position statements.

18.5.9 The Contractor shall take all such measures available to it as are reasonable in the circumstances to apply the waste hierarchy of prevention; preparing for re-use; recycling; other recovery, including energy recovery; and disposal in a way which delivers the best overall environmental outcome. The hierarchy, as illustrated in Diagram 18.2, may be departed from for particular types of waste, where justified, in order to ensure this outcome and by reference to the overall impact of the generation and management of such types of waste.

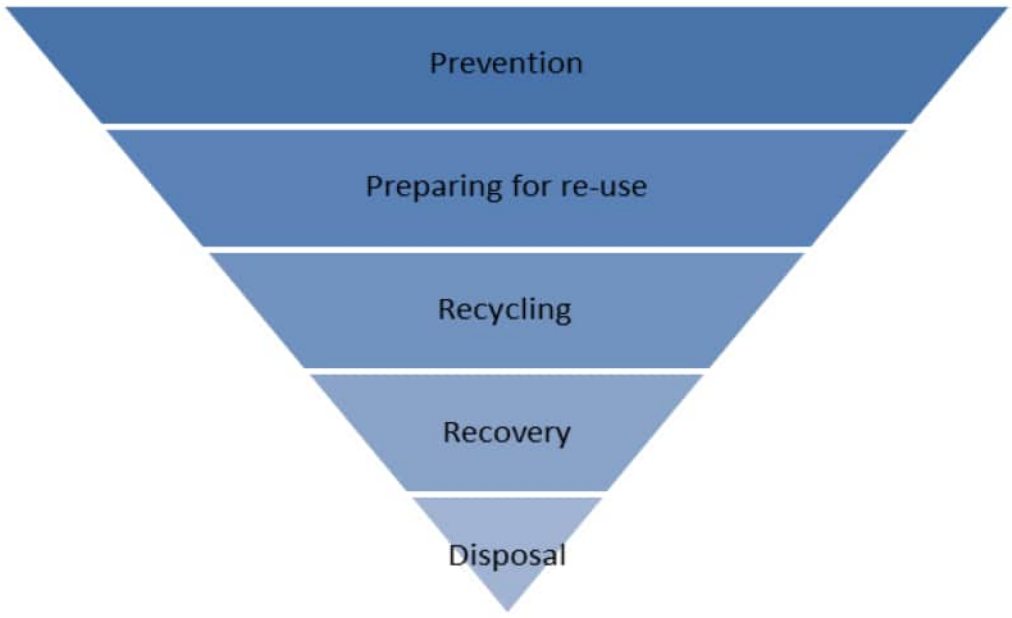

Diagram 18.2: The Waste Hierarchy

Implement Design for Resource Efficient Construction Principles

18.5.10 The project shall implement Zero Waste Scotland's DfRE Construction Principles, throughout the design and construction phases, in order to make the best use of materials over the lifecycle of built assets, to minimise waste and disposal to landfill.

18.5.11 All opportunities to DfRE are covered by five key principles:

- *Design for reuse and recovery*: through salvaging and reuse of components and materials from the site or elsewhere locally; on-site or off-site recycling of materials, and ensuring new materials brought onto site have high recycled content.
- *Design for off-site construction*: through designing in prefabricated road assets structures and components which offer reduced consumption of materials and reduced waste; and thinking about how site activities can become a process of assembly rather than construction.
- *Design for resource optimisation*: through designing road assets that can be constructed and used with reduced consumption of materials, selecting responsibly sourced materials, and producing minimal waste.
- *Design for resource efficient procurement*: through setting resource efficiency requirements into the procurement process; working with the Principal Contractor throughout the design process to select resource efficient construction methods; and when waste does arise, making provision to select the waste contractor who can offer the best overall reuse, recycling or other recovery performance.
- *Design for the future*: through considering the potential future uses of the roads assets and designing in flexibility and adaptability; selecting materials and components to match the intended use and durability; designing the road assets to be easy to maintain and refurbish, and taking into account future needs to update, modernise and eventually deconstruct.

18.5.12 These DfRE principles shall be implemented by applying the simple three-step described below:

- identify opportunities for alternative design solutions which improve resource efficiency, and prioritise those which would have the greatest impact and be easiest to implement;
- investigate the prioritised solutions further to fully ascertain their viability, and quantify the potential benefits; and
- implement the agreed solutions, ensuring that they are agreed with Transport Scotland and recorded by way of the SWMP.

Responsibly Source Construction Materials

18.5.13 The key material elements (aggregates, asphalt, cement, concrete and steel) used within the project shall be specified to be responsibly sourced. All timber and timber products shall similarly be sourced from independently verifiable legal and sustainable sources.

18.5.14 Alternatives to primary aggregates shall be investigated at detailed design, including opportunities to use recycled or secondary aggregates; either sourced from construction, demolition and excavation waste obtained on-site or off-site; or secondary aggregates obtained from by-product of quarrying and mining operations, or aggregates obtained as a by-product of other industrial processes.

Implement a SWMP

18.5.15 A SWMP shall be prepared and implemented in a manner to suit the requirements of the project, to promote resource efficiency during construction. The aim of the SWMP is to ensure that each potential waste stream is evaluated against the waste hierarchy of prevention, prepare for reuse, recycling, other recovery and disposal to derive management options that reflect the highest possible level within the hierarchy which is required by the Waste (Scotland) Regulations 2012. The NetRegs SWMP template and guidance should be used to record these opportunities. The SWMP would allow the Contractor to record actions taken to prevent, reduce, recycle and recover waste arisings, and to identify waste streams and to track them throughout the construction lifecycle.

18.5.16 For most materials, action is best focussed at the top of the waste hierarchy, on reducing use and waste of these materials, and in extending the life of the products which contain them. Zero Waste Scotland's 'Designing out Waste: A Design Team Guide for Civil Engineering Projects', highlights the range of design solution and engineering techniques that can be used to improve materials resource efficiency in civil engineering projects. This is presented in the form of quick reference look-up tables showing the range of opportunities identified so far in the UK to design out waste. The Contractor shall refer to this guide to assist with identifying any further opportunities to design out waste during the construction phase.

18.5.17 The SWMP should contain the following targets applicable to the project; that '*At least 70% of all waste to be recycled, and a maximum of 5% of waste sent to landfill*' in order to support the delivery of the Scottish Government's Zero Waste Plan Targets (Scottish Government, 2010). The SWMP shall also set out how all construction phase materials would be managed. This may include specific materials management plans developed under the following SEPA statutory guidance and industry regulated codes of practice, including but not limited to:

- SEPA, Promoting the sustainable reuse of greenfield soils in construction (2010);
- SEPA, Land remediation and waste management guidelines (2009);
- SEPA, Guidance on the production of fully recovered asphalt road planings (2008);
- SEPA, Recycled aggregates from inert waste (2013); and
- Institution of Civil Engineers (ICE), Demolition protocol (2008).

18.5.18 If contaminated soils are encountered during the construction works, further investigation, testing and risk assessment would be undertaken to determine whether the soils could stay on-site, require treatment to make them suitable to remain on-site or would need to be disposed of off-site. Details for dealing with unexpected contaminated soils would be included in the CEMP. Any waste materials leaving the site would be transported by a registered waste carrier and taken to an appropriately licenced site.

Summary of Potential Mitigation Measures

18.5.19 Table 18.11 summarises potential mitigation measures that would be adopted during the construction of the proposed route options.

Table 18.11: Potential mitigation measures

Project activity	Potential impacts	Description of mitigation measures	How measures would be implemented
Site remediation Preparation Demolition Construction	Depletion of natural resources	▪ Implementation of Zero Waste Scotland's DfRE Construction Principles to make the best use of materials over the lifecycle of the project's built assets, to minimise waste and disposal to landfill. ▪ Where possible the key material elements (i.e. aggregates, asphalt, cement, precast concrete products, ready-mixed concrete and steel) used within the project should be specified to be responsibly sourced. ▪ All timber and wood-derived products (including formwork) should be sourced from independently verifiable legal and sustainable sources. ▪ Alternatives to primary aggregates should be investigated at DMRB Stage 3, including opportunities to reuse materials from the other A9 dualling projects or major development sites in the study area.	▪ Contract documents ▪ Construction Environmental Management Plan ▪ Materials procurement register/ invoices/ certifications records ▪ Materials Management Plans (where required) ▪ Site Waste Management Plan ▪ Weighbridge records/ waste transfer notes/ consignment notes
	Impacts on the available waste management infrastructure	▪ Comply with all relevant waste legislation in relation to waste handling, storage, transport and disposal and consultation with SEPA for advice on waste practice, licences and exemptions where appropriate. ▪ Implementation of Zero Waste Scotland's Designing Out Waste principles for Civil Engineering. ▪ Production of a SWMP (construction contract/ contractor led) to facilitate the prevention, reuse, recycling and other recovery of CD&E waste. ▪ Set project targets to recycle non-hazardous CD&E waste; and to reduce disposal of non-hazardous waste to landfill in line with the Scottish Government's current policies and industry good practice.	

18.6 Summary of Route Options Assessment

18.6.1 This section provides a summary of the DMRB Stage 2 assessment of potential impacts and effects for the proposed route options taking into account the anticipated mitigation as described in Section 18.5. Professional judgement has been used to assess the potential effect and the differences between the proposed route options which are summarised in Table 18.12.

18.6.2 Two aspects are considered; whether any potential residual effects would be considered significant in the context of the EIA Regulations, and whether any of the potential effects identified differ sufficiently between proposed route options that they can be considered a differentiator and need to be considered as part of the overall identification of the Preferred Route Option (which, as explained in Volume 1, Part 3 - Environmental Assessment (Chapter 7: Overview of Environmental Assessment), takes into account environmental, engineering, economic and traffic considerations).

18.6.3 Mitigation, as outlined in this chapter, is expected to reduce the impacts and effects for material assets and waste described for all of the proposed route options.

Construction

Imported Materials

18.6.4 For all proposed route options, detailed design and construction planning would aim to achieve a cut and fill balance to minimise the materials required to be imported to site. It is anticipated that Option ST2C would require the import of earthworks materials, whereas, all the other options can reuse the site won materials and do not require any imported earthwork materials.

18.6.5 Where site won materials are not able to be reused on-site, alternative sources off-site would be reviewed and used where possible for import of materials. If reuse of materials on-site is not possible, then appropriate treatment methods, for example recycling or other recovery, would be sought. Where contaminated materials encountered on-site are not suitable for reuse, it may be possible in some cases to carry out treatment on-site to make them suitable for reuse (see SEPA 'Land remediation and waste management guidelines').

18.6.6 Options ST2A, ST2B and ST2D would require similar volumes of import new pavement material, with the proposed route options varying from 118,000m^3 to 120,000m^3, with Option ST2C requiring 125,000m^3. Information provided on the volume of materials is based on estimated quantities of known materials including earthworks (soil/rock), pavement (bituminous) and pavement (sub-base) and does not represent all materials that would be required for the proposed route options.

Structures

18.6.7 Based on overall comparative cost estimates for structures, Option ST2D has the lowest potential effect, with Option ST2A having the greatest potential effect. All proposed route options have more than 10 separate structures that are proposed to be constructed. There is a small variation between the number of bridges and culverts for the proposed route options. However, Option ST2A includes a 1.5km long cut and cover tunnel, which would require more materials and resource to build.

18.6.8 Option ST2C would be the second most materially intensive option as it has five retaining walls in comparison to two across the other proposed route options as well as a pedestrian underpass. Option ST2B has a 150m vehicle underpass, whereas Options ST2B and ST2D have a pedestrian underpass, and therefore overall have the lowest number of structures to be built. Option ST2D is considered to have the lowest overall effect due to having the lowest comparative structures cost.

Earthworks Materials Surplus/Disposal

18.6.9 There is a difference in the quantity of surplus material and topsoil to be removed between the proposed route options. Option ST2A has the greatest volume of removal at approximately 698,000m^3; Option ST2C has the lowest volume of removal at approximately 145,800m^3. It is noted that acceptable surplus materials for Options ST2A, ST2B and ST2D could potentially be reused, recycled or recovered off-site, which would potentially reduce the amount of material to be disposed of. Whilst materials reuse has environmental benefits, it is also strictly controlled through regulation and legislation such as The Waste Management Licensing (Scotland) Regulations 2011 (as amended).

Waste Arisings from Demolition

18.6.10 All proposed route options would require the demolition of properties. Option ST2B requires five and Options ST2A, ST2C and ST2D would require seven buildings to be demolished. Overall, for construction, the differences in potential effects between proposed route options are considered sufficient to be a differentiator and a comparative assessment is provided in Table 18.12.

Table 18.12: Summary of Assessment – Material Assets and Waste

Chapter/Subcategory			Residual Impacts and Effects				Comments
			Option ST2A	Option ST2B	Option ST2C	Option ST2D	
Material assets and waste	Site remediation/Preparation/ Demolition/Site Construction	Materials import - earthworks	517,100m^3 (Highest surplus)	210,800m^3 (2nd highest surplus)	-286,800m^3 (Highest deficit)	31,500m^3 (Lowest surplus)	Option ST2C requires 286,800m^3 of materials to be imported. All the other options can reuse the site won excavated materials and (based on this assumption) do not require any imported earthwork materials. The differences regarding earthworks materials import between the proposed route options are considered sufficient to be a differentiator.
		Materials import - pavement	118,000m^3 (Lowest import)	120,000m^3 (Joint 2nd highest import)	125,000m^3 (Highest import)	120,000m^3 (Joint 2nd highest import)	For all proposed route options, the new pavement import is between approximately 118,000m^3 to 125,000 m^3. The differences regarding import pavement materials between the proposed route options are not considered sufficient to be a differentiator.
		Materials import - structures	12 structures, including 1.5km tunnel (largest impact)	13 structures (intermediate impact)	16 structures (intermediate impact)	13 structures (lowest impact)	All options include a number of new structures. Although it is Option ST2C which has the largest number of new structures, it is Option ST2A which has the largest impact due to the inclusion of the 1.5km cut and cover tunnel. Options ST2B and ST2D have the lowest number of structures. Notwithstanding this, Option ST2D is considered to have the lowest overall impact due to having the lowest comparative structures cost. The differences regarding materials import for structures between the proposed route options are considered sufficient to be a differentiator.
		Waste - earthworks surplus /disposal	698,000m^3 (Highest total surplus/disposal volume)	355,000m^3 (2nd highest total surplus/disposal volume)	145,800m^3 (Lowest total surplus/disposal volume)	163,000m^3 (2nd lowest total surplus/disposal volume)	All options require at least 7% of the average regional inert landfill capacity forecast to be available during the construction phase. Option ST2C requires the lowest volume of removal of surplus/disposal materials' (145,800 m^3). Option ST2A (698,000 m^3) requires over four times more surplus/disposal materials to be removed in comparison to Option ST2C. There could be an opportunity for materials identified as 'total waste' for Options ST2A, ST2B and ST2D to be reused, recycled or recovered if there is sufficient demand, and subject to waste acceptance criteria. The differences regarding earthworks materials surplus/disposal between the proposed route options are considered sufficient to be a differentiator.
		Waste - demolition	7 demolition sites in total (Joint largest impact)	5 demolition sites in total (intermediate impact)	7 demolition sites in total (Joint largest impact)	7 demolition sites in total (Joint largest impact)	The demolitions required for the proposed route options varies between five to seven buildings. The differences regarding waste arisings from demolition between the proposed route options are not considered sufficient to be a differentiator.

Compliance Against Plans and Policies

18.6.11 DMRB LA 104 'Environmental Assessment and Monitoring' (Highways Agency et al., 2020) states that '*environmental assessment, reporting and monitoring shall meet the requirements of the national planning policy for each relevant Overseeing Organisation*'.

18.6.12 *Appendix A21.1 (Assessment of Policy Compliance)* provides a review of national, regional and local policy documents which are of relevance to the assessment undertaken and reported in this chapter in accordance with DMRB guidance.

18.6.13 National policy objectives (and accompanying best practice guidance) of relevance to this assessment are provided in the National Planning Framework 3 (2014d), Scottish Planning Policy (2014e; revised 2020) themes 'Sustainability' and 'Planning for Zero Waste' as well as Scotland's Zero Waste Plan (Scottish Government, 2010), the Planning and Waste Management Advice (Scottish Government, 2015), The Waste (Scotland) Regulations, Climate Change (Scotland) Act and Climate Change Plan- The Third Report on Proposals and Policies 2018-2032 (2018). In addition, local policies of relevance include Perth and Kinross Local Development Plan 2 (PKC LDP2) Policy 1 (Placemaking) and PKC Supplementary Guidance – Delivering Zero Waste (2020).

18.6.14 A full policy compliance assessment can be found in Table 10 of *Appendix A21.1 (Assessment of Policy Compliance)*. Overall, the design and assessment of the proposed route options has had regard to and is compliant with policy objectives to minimise effects on materials assets and waste. Further assessment will be undertaken at DMRB Stage 3 to identify effects and detailed information and the types and quantities of materials and wastes. However, the assessment of waste and material assets accords with the requirements of national policy through consideration of mitigation, in line with the waste hierarchy.

Community Objectives

18.6.15 There are no specific contributions to meeting the community objectives identified for material assets and waste, further details on contributions to the community objectives from other environmental factors are detailed in *Appendix A7.1: Mapping of Community Objectives Against DMRB Stage 2 Route Options* and the relevant chapters within Volume 1, Part 3 - Environmental Assessment.

Comparative Assessment

18.6.16 The differences between proposed route options for potential impacts and effects during construction on material asset and production of waste are considered sufficient to be a differentiator between proposed route options. It is considered that Option ST2A would have the highest overall effect during construction on material assets and waste. Options ST2B and ST2C are expected to have intermediate effects and Option ST2D is anticipated to have the lowest overall effect on material assets and waste, as shown in Table 18.13.

Table 18.13: Material Assets and Waste Comparative Assessment - Construction

Route Option	Lowest Overall Effect	Intermediate Overall Effect	Highest Overall Effect
Option ST2A			✓
Option ST2B		✓	
Option ST2C		✓	
Option ST2D	✓		

18.7 Scope of Stage 3 Assessment

18.7.1 It is proposed that the DMRB Stage 3 assessment for Material Assets and Waste would be undertaken in accordance with Highways England *et al* (2019c) 'DMRB LA 110 Material assets and waste' which is the published Sustainability and Environment Appraisal standard for this factor.

18.7.2 Further detailed assessment, at DMRB Stage 3, would build on the information reported in this DMRB Stage 2 Environmental Assessment by collating additional data to gain an in-depth appreciation of the environmental consequences of the use and consumption of material assets, as well as the production of waste associated with the Preferred Route Option taken forward.

18.7.3 It would also enable the identification of the key environmental impacts and the significance of effect associated with material assets use and waste; and identify the measures which could be implemented to mitigate the impacts and effects.

18.8 References

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Scottish Government (2003) The Landfill (Scotland) Regulations 2003

Scottish Government (2009) The Climate Change (Scotland) Act

Scottish Government (2009) The Waste Batteries and Accumulators Regulations 2009

Scottish Government (2011a) The Waste Management Licensing (Scotland) Regulations 2011 (as amended)

Scottish Government (2011b) The Waste (Scotland) Regulations 2011 (as amended)

Scottish Government (2012a) Pollution Prevention and Control (Scotland) Regulations 2012 (as amended)

Scottish Government (2012b) The Waste (Scotland) Regulations 2012 (as amended)

Scottish Government (2013a) Waste Electrical and Electronic Equipment (WEEE) Regulations 2013 (as amended)

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19. Climate

19.1 Introduction

19.1.1 This chapter presents the results of the Climate assessment undertaken as part of the Design Manual for Roads and Bridges (DMRB) Stage 2 assessment for the A9 Dualling Pass of Birnam to Tay Crossing, described in Volume 1, Part 3 – Environmental Assessment (Chapter 7: Overview of Environmental Assessment).

19.1.2 The assessment has been produced with reference to DMRB LA 114 'Climate', which indicates that a climate assessment should consider both:

- the potential effects of the proposed route options on climate, in particular the magnitude of and opportunities to reduce greenhouse gas (GHG) emissions during construction and operation; and
- the vulnerability of the proposed route options to climate change, in particular, whether anticipated changes to climatic conditions and/or the frequency of extreme weather events are likely to have significant adverse effects on the project (or elements of the project) during construction and/or operation.

19.1.3 At this stage of design, due to limited data availability, a full assessment of the GHG emissions likely to arise as a result of the construction and operation of each of the proposed route options has not been possible. This assessment therefore focuses on those elements of the construction phase for which data are currently available (namely earthworks, aggregates and soils), whilst also comparing estimated changes in road user GHG emissions as a result of each proposed route option (which are likely to make up a substantial proportion of likely changes in GHG emissions, particularly in future years).

19.1.4 Furthermore, an assessment of the vulnerability of each of the proposed route options to climate change has not been carried out at this stage, as potential climate related impacts are likely to be similar for each of the proposed route options under consideration and are therefore unlikely to differentiate between them. A full assessment of the vulnerability of the Preferred Route Option to possible future changes in climate, in line with DMRB LA 114 Climate, will therefore be undertaken at DMRB Stage 3.

19.1.5 The assessment of effects from the proposed scheme on climate and vice versa, has been informed by relevant information collated by other environmental factors, notably Volume 1, Part 3 – Environmental Assessment (Chapter 18: Material Assets and Waste).

Legislative and Policy Background

19.1.6 The key legislation, policy, plans and statutory guidance influencing the design, construction and assessment of the proposed route options with regard to climate are identified in this section. Further detail of national to local policy is outlined in Volume 1, Part 3 – Environmental Assessment (Chapter 21: Plans & Policies) and an assessment of compliance against these policies of relevance to Climate is provided in Table 11 of *Appendix A21.1 (Assessment of Policy Compliance)*.

<u>International Level</u>

19.1.7 The Intergovernmental Panel on Climate Change (IPCC) AR5 Synthesis report (IPCC, 2014) states in the Summary for Policy Makers 2 that: *'Continued emission of greenhouse gases will cause further warming and long-lasting changes in all components of the climate system, increasing the likelihood of severe, pervasive and irreversible impacts for people and ecosystems. Limiting climate change would require substantial and sustained reductions in greenhouse gas emissions which, together with adaptation, can limit climate change risks'*.

19.1.8 In 1997, the Kyoto Protocol to the United Nations Framework Convention on Climate Change (UNFCCC) was adopted to provide legally binding limits on greenhouse gases (GHG) emissions for 37 countries, including the UK. With regards to the UK, the Protocol set a commitment to reduce GHG emissions by at least 8% below 1990 levels by 2012 (during the first commitment period 2008 - 2012). In 2012, a new objective of a 20% reduction from 1990 levels by 2020 (during the second commitment period 2012 - 2020) was introduced by the Doha Amendment.

19.1.9 In December 2015, the Paris Agreement, a global climate agreement, was adopted. The Paris Agreement was ratified and entered into force in November 2016. The central aim of the Paris Agreement is to strengthen the global response to the threat of climate change by keeping the rise in average global temperature this century to well below 2 degrees Celsius above pre-industrial levels, and to pursue efforts to limit the temperature increase even further to 1.5 degrees Celsius. The UK was one of the 160 countries which signed the agreement. The UK's response to meeting its commitments under the Paris Agreement resulted in the Climate Change Act 2008 (2050 Target Amendment) Order 2019, which set a 'net zero' carbon emissions target by 2050 as detailed in the following paragraphs.

National Level

19.1.10 Through the Climate Change Act 2008, as amended by the 2050 Target Amendment in June 2019, the UK Government has committed to:

- reduce GHG emissions by at least 100% of 1990 levels (net zero) by 2050; and
- contribute to global emission reductions, to limit global temperature rise to as little as possible above 2°C.

19.1.11 To meet these targets, the UK Government has set five-yearly carbon budgets, which currently run until 2032. They restrict the amount of GHG the UK can legally emit in a five-year period. In December 2020, the Committee on Climate Change published its recommendation for the 6th UK carbon budget (Committee on Climate Change, 2020), which is the first budget to be published on a trajectory towards 'net zero'. At the time of writing, however, this budget was yet to be formally adopted into UK law. The carbon budgets during each period and the corresponding reduction compared to 1990 levels are presented in Table 19.1.

Table 19.1: UK Government Carbon Budgets

Carbon Budget Period	Carbon Budget ($MtCO_2e$)	Reduction below 1990 levels
3rd Carbon Budget (2018 to 2022)	2,544	37% by 2020
4th Carbon Budget (2023 to 2027)	1,950	51% by 2025
5th Carbon Budget (2028 to 2032) [a]	1,725	68% by 2030
6th Carbon Budget (2033 to 2037)	965	78% by 2035

[a] Originally 57% when 5th Carbon Budget was enshrined in law, has recently been increased to 68% as the UK's Nationally Determined Contribution ahead of the UN's COP26.

19.1.12 The Climate Change (Scotland) Act 2009 established a framework for Scotland to achieve its long-term goals of reducing GHG emissions by at least 80% by 2050. An interim target of a 42% reduction by 2020 was also set. The original 2050 goal was amended through the Climate Change (Emissions Reduction Targets) (Scotland) Act 2019 that was passed in September 2019, which set a 'net-zero emissions target' for all GHG emissions by 2045. The interim targets were amended to become 56% by 2020, 75% by 2030 and 90% by 2040.In the context of the Climate Change (Scotland) Act 2009, Scottish Ministers are obliged to lay a report in Parliament setting out their proposals and policies for meeting annual emissions reduction targets. This Climate Change Plan (CCP) is the Scottish Government's third Report on Proposals and Policies RPP3) for meeting its climate change targets for the period 2018–2032. In RPP3, special reference is made to Transport Scotland and related policies and plans.

19.1.13 In December 2020, the Scottish Government released the Climate Change Plan 2018-2032 update, which recognised the enormous challenges caused by the COVID-19 pandemic and the effect these could have on the ability of the Scottish Government to meet its GHG emissions reduction targets. The Update makes clear, however, that the Scottish Government remains absolutely committed to ending Scotland's contribution to climate change, despite these challenges. As such, it aims for a 'green recovery' that captures opportunities to transition towards 'net zero' through the creation of green jobs, by developing sustainability skills, improving wellbeing and addressing inequalities (Scottish Government, 2020a).

19.1.14 The Scottish Government's publication 'The Government's Programme for Scotland 2019-20' sets out an objective to phase out all new petrol and diesel cars by 2030. An ambition is also expressed to create the conditions to phase out the 'need' for all new petrol and diesel vehicles in Scotland's public sector fleet by 2030 and all petrol and diesel cars from the public sector fleet by 2025. This publication highlights the importance of continued investment in the trunk road network with a focus on completing the A9 Dualling Programme to provide economic growth throughout Scotland. Such activities are likely to result in a substantial reduction in Scottish road traffic related GHG emissions over time.

19.1.15 The second Scottish Climate Change Adaptation Programme 2019 – 2024 (SCCAP) sets out policies and proposals to prepare Scotland for the challenges that will be faced as climate continues to change in the decades ahead. The SCCAP is a requirement of the Climate Change (Scotland) Act 2009 and addresses the risks set out in the UK Climate Change Risk Assessment (UK CCRA) 2017, published under Section 56 of the UK Climate Change Act 2008.

19.1.16 The National Planning Framework 3 (NPF3) identifies a vision for Scotland that is *'…a low carbon place. We have seized the opportunities arising from our ambition to be a world leader in low carbon energy generation, both onshore and offshore. Our built environment is more energy efficient and produces less waste and we have largely decarbonised our travel …'* (Scottish Government, 2014a, p.1). NPF3 also states that: *'The pressing challenge of climate change means that our action on the environment must continue to evolve, strengthening our longer-term resilience '(*2014a, p.43).

19.1.17 It should be noted that the NPF4 is expected to be published in 2021, which will provide a spatial planning response to the Global climate emergency up to 2050. As per the NPF4 Position Statement (Scottish Government, 2020b), the proposed key objective of NPF4 is to ensure planning policy results in spatial and land use change that facilitates Scotland's ambition to have 'net-zero' emissions by 2045 and meet other statutory emissions reduction targets, whilst also supporting communities and businesses in making the changes needed to meet the targets. One of the main issues to be considered is the policy criteria needed to ensure that new developments, including transport and infrastructure, contribute as far as possible to meeting emission reduction targets.

19.1.18 The Scottish Planning Policy (SPP) states that:

'NPF3 will facilitate the transition to a low carbon economy, particularly by supporting diversification of the energy sector. The spatial strategy as a whole, aims to reduce greenhouse gas emissions and facilitate adaptation to climate change. … The Climate Change (Scotland) Act 2009 sets a target of reducing greenhouse gas emissions by at least 80% by 2050, with an interim target of reducing emissions by at least 42% by 2020. Annual greenhouse gas emission targets are set in secondary legislation. Section 44 of the Act places a duty on every public body to act:

- *in the way best calculated to contribute to the delivery of emissions targets in the Act;*
- *in the way best calculated to help deliver the Scottish Government's climate change adaptation programme; and*
- *in a way that it considers is most sustainable.*

The SPP sets out how this should be delivered on the ground. By seizing opportunities to encourage mitigation and adaptation measures, planning can support the transformational change required to meet emission reduction targets and influence climate change. Planning can also influence people's choices to reduce the environmental impacts of consumption and production particularly through energy efficiency and the reduction of waste.' (Scottish Government, 2014b, p.7; Revised 2020)

19.1.19 Both NPF3 and SPP highlight the planning outcome *'A low carbon place – reducing our carbon emissions and adapting to climate change'*.

19.1.20 In February 2020, the Scottish Government released its latest Environment Strategy. In the strategy it is stated that *'By 2045: By restoring nature and ending Scotland's contribution to climate change, our country is transformed for the better - helping to secure the wellbeing of our people and planet for generations to come'* (Scottish Government, 2020c, p.3).

Local Level

19.1.21 Perth & Kinross Council (PKC), in line with the Climate Change (Scotland) Act 2009, has undertaken Climate Change commitments by signing Scotland's Climate Change Declaration (SCCD) in 2007. In becoming a signatory of the SCCD, PKC has made a commitment to:

- provide effective leadership, governance and management on climate change
- reduce the local authority's own 'corporate' greenhouse gas emissions
- reduce emission in the local authority area
- assess and adapt to the risk of climate change impacts
- develop effective partnership working and climate change communications, including annual statement of plans, activities and achievements.

19.1.22 PKC's publication 'Sustainable Design and Zero Carbon Development' (2014) sets the following policy for construction projects: *'Sustainable design and construction will be integral to new development in Perth and Kinross. Applications for development may require a Sustainability Statement to demonstrate how developments will uphold sustainable construction principles and contribute to mitigating and adapting to climate change and to meeting targets to reduce carbon dioxide emissions…'.*

19.1.23 PKC's Community Plan 2017 – 2027 (2017), Corporate Plan 2018 – 2022 (2018) and Local Development Plan (2019), all include aspirations to address climate change through mitigation (reducing emissions) and adaptation (improving resilience to the impacts of climate change).

19.1.24 In June 2019 PKC acknowledged its responsibilities relating to climate change by unanimously passing a motion, which committed the Council to lead by example in accelerating the transformational change required to address the climate emergency. The Chief Executive was tasked with setting out a route map to deliver through co-production with citizens and other stakeholders, a low carbon Perth & Kinross. In this context, the first 'Interim Climate Emergency Report and Action Plan' setting out specific climate change mitigation and adaptation actions was released in December 2019.

Client Level

19.1.25 Transport Scotland publishes the Carbon Account for Transport on an annual basis which provides a balance sheet for Scotland's GHG emissions due to transport. The most recently published version is the Carbon Account for Transport No. 12: 2020 which is further referenced in Section 19.4 (Assessment of Impacts and Effects).

19.1.26 The Road Asset Management Plan for Scottish Trunk Roads - RAMP (2016) identifies Environmental Sustainability as one of its main objectives and specifically commits *'…to protect the environment by minimising carbon emissions and promote the use of sustainable materials used on road maintenance work'*. Furthermore, it identifies weather related disruption due to climate change as one of the major risks in network management.

19.1.27 Transport Scotland's publication 'Scottish Road Network Climate Change Study: Progress of Recommendations' (2008) sets out the progress made in meeting the recommendations within the Scottish Government's 'Scottish Road Network Climate Change Study' (2006). This study analysed the potential trends in climate change in Scotland and the implications this may have for road networks, including weather related elements such as temperature, rain, coastal flooding and more. The recommendations set out in this report are to adapt to the impacts of such climate change related weather events, which are to be considered for both the design and operation of road networks. Of the 28 recommendations presented in Transport Scotland's progress report (6 priority, 10 short-term and 12 long-term recommendations), nine have been met with ten in progress and nine pending action.

19.2 Approach and Methods

Scope

19.2.1 This assessment addresses 'Climate' in accordance with DMRB LA 101 'Introduction to environmental assessment' (Highways England et al., 2019a), which identifies 'Climate' as an environmental factor to be assessed.

19.2.2 Specifically, this assessment has been prepared in accordance with DMRB LA 114, supplemented by the Scotland National Application Annex (NAA) to LA 114 Climate[1] (Highways England et al., 2019b). These documents set out the requirements for assessing and reporting the effect of GHGs from construction, operation and maintenance of motorway and all-purpose trunk road projects on climate, and the effects of climate on highways (climate change resilience and adaptation).

GHG emissions

19.2.3 The potential GHG emissions sources scoped in/out of this assessment are summarised in Table 19.2, for construction and operation. DMRB LA 114 advises that a proportionate approach should be applied to capture the principal contributing factors to the overall GHG emissions associated with a project.

[1] Transport Scotland has provided the draft NAA for LA 114 to inform this assessment. It is anticipated that the NAA will be published shortly in Revision 1 of LA 114.

19.2.4 Whilst DMRB LA 114 sets out the requirements for assessing and reporting the effects on Climate, this standard is primarily aimed at compliance with the EIA Directive and guiding statutory EIA carried out at DMRB Stage 3 – Preliminary Design, where there is much greater certainty around the design of the Preferred Route Option.

19.2.5 DMRB LA 114 does not provide a separate methodology for the options selection/preliminary design stage (DMRB Stage 2) where it is often not possible to quantify material requirements and forecast waste generation in absolute terms. Therefore, the quantification of emissions from construction and operation focuses on the components of the design for which construction information is available for the route options being considered. On this basis, GHG emissions were not estimated for a number of sources, the justification for which is as follows:

- With regards to construction and installation, information regarding on-site construction activities, fuel usage electricity and water consumption was not available and therefore the associated emissions were not considered further. However, it is likely that these factors would not be considered sufficient to differentiate between the proposed route options.
- Detailed design information was not available for the following key materials and therefore not included at this stage of the assessment:
  - Concrete;
  - Steel; and
  - Asphalt and Bitumen.
- Emissions associated with maintenance of the proposed route options have also not been assessed at DMRB Stage 2 due the limited information available on construction materials described above, as these data are also used to derive likely materials consumed during maintenance (e.g. based on assumed replacement frequencies). Neither was it possible to estimate emissions associated with fuel and electricity consumption during maintenance activities.
- DMRB LA 114 states that *'a proportionate approach shall be applied to calculating and reporting GHG emissions from changes in land use and forestry (i.e. reporting only where there is likely to be a substantial change)'*. As detailed in Volume 1, Part 3 – Environmental Assessment (Chapter 9: Geology, Soils and Groundwater), the proposed route options and related construction activities are unlikely to encounter peat soils, an important carbon sink, and therefore GHG emissions associated with land use change are considered unlikely to be substantial. On this basis, GHG emissions associated with Land Use Change and Forestry (LULCUF) have not been considered in this DMRB Stage 2 assessment.
- GHG emissions from the decommissioning of the scheme at the end of its life are not considered, in line with DMRB LA 114.
- No information was available on operational electricity consumption (e.g. lighting), therefore it was not possible to estimate associated emissions. Such emissions are however likely to be negligible and can be mitigated by using energy efficient lighting.

Table 19.2: GHG Emission Sources Included in the Assessment

Main stage of project life cycle	Sub-stage of life cycle	Potential sources of GHG emissions	Scoped in (✓) /out (✗)	Data
Construction	Product stage; including raw material supply and manufacture.	Embodied GHG emissions associated with the required raw materials for the main works for the route options include: ▪ addition of carriageways ▪ multiple junctions	✓	Estimates of the following materials were provided by the design team for each of the route options ▪ bulk earthwork balance ▪ aggregates ▪ waste arisings for aggregates and earthworks.
	Construction process stage: including transport to/from works site and construction/installation processes.	Fuel or electricity consumption by: ▪ construction plant and other machinery ▪ workers commuting ▪ water consumption ▪ other on-site construction activities.	✗	N/A
		GHG emissions associated with Heavy Duty Vehicle (HDVs) delivering materials to site.	✓	An indicative assessment of emissions from transportation for the material quantities available has been carried out based on the assumptions set out within the Carbon Management Tool.
		GHG emissions associated with the transportation and treatment of waste materials.		
	Land use change	GHG emissions mobilised from vegetation or soil loss during construction.	✗	N/A
Operation	Use of the infrastructure by the operational road users.	Vehicles using highways infrastructure.	✓	Traffic data (i.e. traffic flows, % HDVs, daily average vehicle speed) under the Do-Minimum and Do-Something scenarios for the Affected Road Network (ARN).
	Operation and maintenance (including repair, replacement and refurbishment).	Materials' embodied GHG emissions used for cyclical maintenance throughout the lifespan of the scheme	✗	N/A
		Fuel or electricity consumed during maintenance activities.	✗	N/A
		Operational electricity consumption (e.g. lighting)		
	Land use and forestry.	Ongoing land use GHG emissions/sequestration each year.	✗	N/A

Study Area

19.2.6 In line with DMRB LA 114, different study areas are required to be defined for each aspect of a climate assessment. The study areas are defined as follows:

- for GHG emissions resulting from the construction process and operational maintenance, the study area is limited to the footprint of the proposed route options, GHG emissions associated with materials' embodied GHG emissions and transportation, and the transportation and treatment of waste materials; and
- for GHG emissions resulting from operational road users, the study area is consistent with the Affected Road Network (ARN) (defined in accordance with the traffic change criteria defined in DMRB LA 105 'Air Quality'). As for other sections of the A9 Dualling Programme, the study area has been limited to an area within 500m of the proposed route options' footprint in order to avoid the double counting of road user GHG emissions associated with other sections.

Consultation

19.2.7 Volume 1, Part 3 – Environmental Assessment (Chapter 7: Overview of Environmental Assessment) provides a summary of the consultation process at DMRB Stage 2.

Assessment Methodology

19.2.8 This DMRB Stage 2 assessment primarily focuses on the potential impacts arising from the release of GHG emissions during construction and operation of each of the proposed route options. The assessment follows the guidance as set out in DMRB LA 114.

Construction Stage

19.2.9 Transport Scotland has developed and implemented a Carbon Management System (CMS) as a suite of tools to measure Scope 1, 2 and 3 GHG emissions associated with their construction and maintenance activities, across their road and rail schemes.

19.2.10 The 2016 version of Transport Scotland's Projects Carbon Tool is part of the CMS suite of tools (this tool is currently being updated and the DRMB Stage 3 assessment will utilise the new version if available). The tool is used to estimate GHG emissions associated with civil and structural engineering projects, including road, rail and buildings. The CMS fulfils two roles:

- it enables consistent and objective measurement and reporting of GHG emissions from Transport Scotland's construction and maintenance operations and schemes; and
- it supports design and construction optioneering.

19.2.11 Whole life GHG emissions can be estimated for projects based on the embodied GHG associated with the materials used, the transport of materials and waste, site plant energy consumption, any operational energy and emissions associated with structural maintenance.

19.2.12 As set out in Table 19.2 the following emissions have been considered in this assessment:

- GHG emissions associated with the manufacture and transportation of known raw materials; and
- emissions associated with the transport and treatment of waste soils.

19.2.13 As outlined in paragraph 19.2.5, DMRB LA 114 does not prescribe a methodology for DMRB Stage 2, where it is often not possible to quantify material requirements and forecast waste generation in absolute terms. As such, a semi-quantitative assessment has been undertaken, appropriate to DMRB Stage 2, using available information and professional judgement. The following information has therefore been used during the assessment in order to provide an indication of the relative magnitude of materials use and forecast waste generation for each option, thereby allowing a high-level, but meaningful comparative assessment of the proposed route options to be undertaken:

- estimated quantities of material consumption;
- estimates of the number of structures to be demolished;
- estimates of the number of new structures and structures cost; and
- estimated quantities of surplus earthworks materials.

19.2.14 This chapter includes materials estimates for each of the proposed route options, and where material volumes could not be estimated (e.g. for structures), the anticipated number and type or cost of structures has been taken as a proxy for the volume of material required, waste likely to be generated and ultimately the emissions. As such, the values underpinning this assessment are indicative only; and based on standard assumptions, DMRB Stage 2 level of design, and ground/site information.

19.2.15 This assessment therefore generally focusses on the variation between proposed route options and this variation has been used for the purposes of comparative assessment. Professional judgement has informed determination of material and wastes quantities, and whether the variation between each proposed route is considered sufficient to be a differentiator for the selection of a Preferred Route Option. The DMRB LA 114 significance criteria are not considered to be a useful differentiator of effects at this stage.

Operational Road User Emissions

19.2.16 Operational Road User GHG emissions were calculated in line with DMRB LA 114 for the Do-Minimum and Do-Something scenarios for the opening and design years (2026 and 2041, respectively) using the emission estimation approach defined within the Transport Analysis Guidance (TAG) Data Book (July 2020). GHG emissions for the interim years between the opening and design year were linearly interpolated, whereas from the design year to the end of life of the proposed route options (assumed to be 60 years from scheme opening in line with DMRB LA 114), GHG emissions were assumed to remain constant.

19.2.17 Operational road user GHG emissions were calculated based on Annual Average Daily Traffic (AADT) flows, percentage Heavy Duty Vehicle (HDVs) and average vehicle speeds, for each road link in the study area.

Impact Assessment

19.2.18 Specific human or natural receptors are not considered in the GHG emissions assessment as the receptor being considered is global climate. Consequently, the exact location of GHG emissions sources does not alter the potential impact and resulting effect.

19.2.19 The assessment of the proposed route options' impacts and effects on climate therefore relies on a comparison of project related GHG emissions against UK Government or Overseeing Organisation carbon budgets. In this context, DMRB LA 114 indicates that significant effects should only be reported where increases in GHG emissions will have a material impact on the ability of Government to meet its carbon reduction targets in line with the carbon budgets outlined in the Table 19.1. Potential impacts and effects are assessed including embedded mitigation (design measures which are integrated into a project for the purpose of minimising environmental effects).

19.2.20 Project related GHG emissions have therefore been compared to UK Government carbon budgets and Scottish Government interim carbon reduction targets within this assessment. Whilst no specific guidance is provided within DMRB LA 114, or elsewhere, on the magnitude of a change in GHG emissions (relative to UK carbon budgets) which could be considered significant, for the purposes of this assessment, and based on professional judgement, changes less than 0.1% of the relevant carbon budget have been considered to be negligible and therefore not significant.

Community Objectives

19.2.21 At an early stage in the A9 Co-Creative Process, the Birnam to Ballinluig A9 Community Group generated community objectives. The seven community objectives are presented in Volume 1, Part 3 – Environmental Assessment (Chapter 7: Overview of Environmental Assessment)) and cover a wide range of factors but focus predominantly on environmental issues.

19.2.22 The community objectives have been taken into consideration throughout the DMRB Stage 2 process, and a mapping exercise was conducted to indicate how, in the operational phase, the proposed route options could contribute to the relevant objectives. Details of how each environmental factor contributes towards achieving the community objectives are presented in *Appendix A7.1: Mapping of Community Objectives Against DMRB Stage 2 Route Options* and a summary for this chapter is presented in Section 18.6.

Limitations to Assessment

19.2.23 It should be noted that this DMRB Stage 2 assessment was prepared prior to and during the global COVID-19 coronavirus pandemic. Throughout 2020 and in early 2021, there have been significant and extensive restrictions in place in Scotland on the movement of people and the activities that are permitted. Due to the duration and extent of such restrictions, some of the baseline and survey updates within this DMRB Stage 2 assessment have not been achievable.

<u>Construction, Maintenance and Operational Needs</u>

19.2.24 There is limited information available at this stage of the DMRB assessment regarding the following DMRB LA 114 assessment parameters:

- types and quantities of materials required for construction;
- types and quantities of materials required for operational maintenance;
- energy and utility usage from construction activities;
- the type and volume of materials that will be recovered from on or off-site sources;
- the cut and fill balance; and
- types and quantities of waste arising from construction (demolition, excavation arisings and remediation) requiring disposal to landfill.

19.2.25 The above limitations are typical of a DMRB Stage 2 assessment, and the assessment reported in this chapter is considered robust and of an appropriate level to provide an assessment of the proposed route options.

Operational Road Users

19.2.26 There are a number of limitations and uncertainties inherent within the Transport Analysis Guidance (TAG) Data Book approach used to inform the estimation of operational road user GHG emissions. Of particular relevance are projected proportions of electric vehicles in future years, which are inherently uncertain. This approach and these projections are, however, considered the most robust currently available.

19.2.27 Uncertainties or limitations related to the road traffic data on which road user GHG emissions calculations are based are discussed within Volume 1, Part 4 – Traffic and Economic Assessment.

19.3 Baseline Conditions

Baseline GHG emissions

19.3.1 The proposed route options are located within the administrative boundaries of PKC. PKC's estimated council-wide CO_2 emissions, obtained from the most recent UK National Atmospheric Emissions Inventory (NAEI) dataset for local authorities (i.e. 2020), are presented in Table 19.3 and compared with relevant emission totals for Scotland as a whole.

19.3.2 Estimated total net council-wide CO_2 emissions are 900 kt, which accounts for approximately 3.1% of estimated total net emissions in Scotland. It should be noted however that Land Use, Land Use Change and Forestry (LULUCF) are estimated to have a substantial positive impact on total net CO_2 emissions in the area administered by PKC (i.e. - 259 kt).

19.3.3 Road transport related CO_2 emissions in the area administered by PKC (602 kt) are estimated to have accounted for 51.9% of total emissions (prior to LULUCF being considered) and 5.6% of total road transport related CO_2 emissions in Scotland. 'A roads' (including the A9) are estimated to have contributed 34.4% of total PKC emissions (prior to LULUCF being considered) and 8.0% of 'A road' transport related CO_2 emissions in Scotland.

Table 19.3: Estimated CO_2 emissions (kt) from activities within PKC (2018)

PKC CO_2 emissions in 2018 (kt CO_2)			
Industry and Commercial Electricity	92	Domestic 'Other Fuels'	59
Industry and Commercial Gas	61	Road Transport (A roads)	399
Large Industrial Installations	0	Road Transport (Motorways)	126
Industrial and Commercial Other Fuels	40	Road Transport (Minor roads)	77
Agriculture	80	Diesel Railways	10
Domestic Electricity	79	Transport Other	3
Domestic Gas	134	LULUCF Net Emissions	-259
Total net emissions			900
A roads/Total PKC CO_2 emission (excluding LULUCF)	34.4%	Road transport/Total PKC CO_2 emissions (excluding LULUCF)	51.9%
PKC/Scotland Total net CO_2 emissions	3.1%	PKC/Scotland Road Transport CO_2 emissions	5.6%

19.3.4 As identified in Transport Scotland's Carbon Account for Transport No. 12 (2020), road transport GHG emissions in 2018 are estimated to have accounted for 68% of Scotland's total transport emissions and 24% of total emissions in Scotland. It should be noted that whilst total GHG emissions in Scotland are estimated to have reduced by 1.5% between 2017 and 2018 (and by 45.5% below the 1990 baseline), road traffic emissions are estimated to have increased in recent years (7% from 2011 to 2018), increasing their relative contribution. These divergent trends are due to the fact that, increases in vehicle kilometres travelled have outweighed improvements in vehicle efficiency over this period, whilst emissions associated with electricity consumption have reduced substantially due to the continued switch away from coal towards gas and renewable energy. In 2018, however, Scottish road transport emissions are estimated to have declined for the first time since 2013.

Proposed Route Options Baseline

19.3.5 The baseline against which the proposed route options have been compared is the 'Do-Minimum' (DM) scenario. DMRB LA 114 indicates that the GHG emission sources considered within the DM scenario should include current operational maintenance works (e.g. materials' embodied emissions), operational electricity use (e.g. lighting) and operational road users (i.e. vehicles' fuel consumption) for the existing road network. At the time of writing, however, data were only available for the latter, while no electricity is currently used for lighting purposes. Therefore, the DM scenario for the proposed route options is based only on the GHG emissions released by operational road users in the DM traffic scenario. However, it should be noted that operational road user GHG emissions typically comprise the vast majority of total operational emissions for a road scheme.

19.3.6 The GHG emissions for the DM scenario are presented in Table 19.4 for the base year (2015), the opening year (2026), the design year (2041) and over the assumed life span of the scheme (i.e. 60 years).

Table 19.4: GHG Emissions (tCO_2e) for the Do-Minimum Scenario

Year	Operational road user GHG emissions (tCO_2e)
Base Year (2015)	13,124
Opening Year (2026)	12,994
Design Year (2041)	12,024
Whole life carbon (60 years)	729,224

19.4 Potential Impacts and Effects

Construction

19.4.1 Construction of the proposed route options has the potential to result in the consumption of substantial quantities of raw materials. These materials have an 'embodied' carbon content, which reflects the emissions generated during the extraction of their constituent raw materials and the manufacturing process. The transportation of materials to site and engineering processes also release emissions from the combustion of fuels in vehicles, site equipment and utilities.

19.4.2 Construction of the proposed route options would release GHG emissions from the transport and treatment of waste material from demolition, construction and excavated soils. .

19.4.3 Transport Scotland's CMS Tool was used to estimate the GHG emissions associated with the proposed route options as explained in Section 19.2 (Assessment Methodology). The results are summarised in Table 19.6. A conservative approach was adopted in the calculations including a 15% contingency to cover unknown items.

Earthworks

19.4.4 To provide stable ground for construction of road infrastructure, excavation of soils is required, however, GHG emissions are released during earthworks from the use of fuel in excavation plant on site and in vehicles to transport soils to and from the construction site. The design of the route options should therefore look to achieve a 'cut and fill balance' as far as is practicable. This would minimise the requirement to import additional soils as well as export excess soils from the site. Volume 1, Part 3 – Environmental Assessment (Chapter 18: Material Assets and Waste) provides information on the estimated earthwork quantities for the proposed route options. The estimated GHG emissions from earthworks is provided in Table 19.6 which indicates Options ST2A and ST2C have the greatest impact on emissions, resulting in 10,386 tCO_2e and 16,439 tCO_2e respectively. Option ST2D would be expected to have the lowest impact on emissions at 2,411 tCO_2e.

Pavement

19.4.5 The proposed route options would require the consumption of materials to construct the road pavement on the mainline, junctions, underpasses, and side roads. Road pavement contains carbon intensive materials including bitumen, asphalt, and aggregates. The manufacture of these materials has an embodied carbon content from the energy used in raw material extraction and the energy intensive manufacturing processes. The transport of these materials from the point of manufacture to the construction site also results in GHG emissions from vehicles. Volume 1, Part 3 – Environmental Assessment (Chapter 18: Material Assets and Waste) provides information on the known pavement material quantities for the proposed route options. The estimated emissions from pavement aggregates is provided in Table 19.6 which indicates similar emissions from imported pavement aggregates for Options ST2A, ST2B and ST2C. At this stage, Option ST2D is estimated to have the lowest effect on emissions.

Structures

19.4.6 The proposed route options have requirements for civil engineering structures such as bridges, tunnels and underpasses. Civil engineering structures are constructed using carbon intensive raw materials including concrete and steel. These materials release emissions from the extraction of raw materials and the energy intensive processes involved in the manufacturing process. The transportation of these materials from the point of manufacture to the construction site also results in emissions from the vehicles.

19.4.7 Estimates of the quantities of materials for structures are not available at this stage of design development. However, the estimated comparative costs of the structures and the number of each type of structure for each proposed route option are available and have been considered to provide a qualitative assessment of the likely level of GHG emissions.

19.4.8 It would be expected that the proposed route options with the highest comparative structure costs and the greatest number of new structures would generally correlate with the greatest quantities of material requirements and therefore result in the highest GHG emissions due to the requirement for greater amounts of carbon intensive construction materials. The estimated comparative structure costs for each proposed route option and the number of each structure type are provided in Table 19.5. In summary:

- Option ST2A includes a 1.5km cut and cover tunnel, which would be expected to result in a large amount of GHG emissions, due to the requirement for a large volume of concrete and steel for piling and to construct the tunnel.
- Option ST2C has the greatest number of retaining walls of all the proposed route options which would create a high demand for concrete and steel, resulting in increased GHG emissions.
- Option ST2B includes a 150m underpass for the main alignment. This is a major structure which would require high quantities of concrete and steel, resulting in increased GHG emissions.

Table 19.5: Estimated cost of structures and number of each structure type

Proposed Route option	Comparative estimated cost of structures*	No. of bridges	No. of culverts	No. of retaining walls	No. of tunnels	No. of underpasses
Option ST2A	360%	7	2	2	1**	0
Option ST2B	130%	8	2	2	0	1***
Option ST2C	150%	9	1	5	0	1****
Option ST2D	100%	9	1	2	0	1****

* Estimated structure costs presented as comparative values. The lowest cost option is assigned 100%, and the remaining options are expressed as a percentage of this (i.e. 110% would be 10% more expensive than the lowest cost option).
** Cut and cover tunnel length is approximately 1.5km
*** Underpass length is approximately 150m
**** Pedestrian underpass only

Waste

19.4.9 Waste arisings from surplus or defective materials during construction has an effect on GHG emissions as a result of the requirement to transport the waste from the construction site to an appropriate waste treatment facility. Processing of waste at facilities also releases GHG emissions, the quantity of which is dependent on the energy intensity of the treatment option, such as incineration, landfill or recycling, with recycling resulting in fewer GHG emissions than incineration, for example. At this stage it is not possible to accurately quantify how much waste would be generated for each proposed route option through demolition activities, therefore for the purposes of comparative assessment, similar amounts of waste generated per demolition has been assumed. Greater detail on waste arisings considered at this stage of assessment is presented in Volume 1, Part 3 – Environmental Assessment (Chapter 18: Material Assets and Waste).

Summary of Emissions

Table 19.6: Estimated emissions from known materials and waste arisings

Route option	Emissions (tCO_2e)			
	Imported soils	Imported Pavement aggregates	Earthwork Disposal	Total
Option ST2A	0	5,525	10,386	15,911
Option ST2B	0	5,619	5,283	10,902
Option ST2C	14,206	5,853	2,143	22,202
Option ST2D	0	562	2,411	2,973

Operation

19.4.10 The GHG sources considered for the operation phase are operational road users (i.e. vehicular emissions associated with the consumption of fuel).

19.4.11 GHG emissions from operational road users were calculated for the Do-Something (i.e. with scheme) scenario for each proposed route option in the 2026 opening year scenario and 2041 design year scenario, and extrapolated until 2085 (the assumed end of life year of the scheme) i.e. over a 60-year appraisal period. The results of these calculations are summarised in Table 19.7.

Table 19.7: Operational Road User GHG Emissions (tCO_2e) for the Do-Something Scenarios

Year	Operational Road User GHG emissions (tCO_2e)			
	Option ST2A	Option ST2B	Option ST2C	Option ST2D
Opening Year (2026)	17,222	17,488	17,335	17,199
Design Year (2041)	15,422	15,571	15,442	15,370
Whole life GHG emissions (60 years, i.e. 2026-2085)	939,739	949,589	941,651	936,833

19.4.12 Estimated GHG emissions are projected to decrease by 10-11% between 2026 and 2041 with all proposed route options indicating that the anticipated increase in traffic flows over this period is outweighed by the estimated benefits resulting from improvements to the vehicle fleet (e.g. increased proportions of electric vehicles).

Impacts and Effects Specific to Option ST2A

19.4.13 Estimated construction and operational road user GHG emissions for Option ST2A, split per carbon budget period, are summarised in Table 19.8.

Table 19.8: GHG Emissions for Option ST2A – Total Do-Something Emissions Per Budget Period

Emission Source	GHG Emissions distributed per Carbon Budget (tCO_2e)		
	4th (1,950 $MtCO_2e$)	5th (1,725 $MtCO_2e$)	6th (965 $MtCO_2e$)
Construction	15,911	-	-
Operational road users	34,324	83,710	80,711
Total	**50,235**	**83,710**	**80,711**

19.4.14 Comparisons of the net change in GHG emissions for Option ST2A against the relevant UK carbon budgets and Scottish carbon reduction interim targets (i.e. 2030 and 2040) are summarised in Table 19.9 and Table 19.10, respectively.

19.4.15 From Table 19.9, it can be seen that the change in GHG emissions expected to result from Option ST2A, is estimated to be negligible relative to each carbon budget, accounting for approximately 0.001% of the 4th carbon and 5th carbon budgets and approximately 0.002% of the recommended 6th carbon budget.

19.4.16 The net changes in GHG emissions for the years that Scottish interim targets have been defined (i.e. 2030 and 2040) shown in Table 19.10 are equivalent to 0.026% and 0.045% of the corresponding targets, respectively, which is again considered negligible.

Table 19.9: Net Change in GHG Emissions (Option ST2A vs. Do-Minimum) Compared with Relevant UK Carbon Budgets

Emission Source	Emission Source			Change as Percentage of Relevant Carbon Budget (%)		
	4th	5th	6th	4th (1,950 $MtCO_2e$)	5th (1,725 $MtCO_2e$)	6th (965 $MtCO_2e$)
Construction	15,911	-	-	<0.001%	-	-
Operational road users	8,400	20,032	18,649	<0.001%	0.001%	0.002%
Total	**24,311**	**20,032**	**18,649**	**0.001%**	**0.001%**	**0.002%**

Table 19.10: Net Change in GHG Emissions (Option ST2A vs. Do-Minimum) Compared with Scottish Interim Targets

Emission Source	Net Change in GHG Emissions in Interim Target Year (tCO_2e)		Net Change in GHG emissions as Percentage of Scottish Interim Target (%)	
	2030	2040	2030 (19$MtCO_2e$)	2040 (7.6$MtCo_2e$)
Construction	5,304	-	0.028%	-
Operational road users	4,006	3,453	0.021%	0.045%
Total	**9,310**	**3,453**	**0.049%**	**0.045%**

Impacts and Effects Specific to Option ST2B

19.4.17 Estimated construction and operational road user GHG emissions for Option ST2B, split per carbon budget period, are summarised in Table 19.11.

Table 19.11: GHG Emissions for Option ST2B – Total Do-Something Emissions Per Budget Period

Emission Source	GHG Emissions distributed per Carbon Budget (tCO_2e)		
	4th (1,950 $MtCO_2e$)	5th (1,725 $MtCO_2e$)	6th (965 $MtCO_2e$)
Construction	10,902	-	-
Operational road users	34,847	84,882	81,688
Total	**45,749**	**84,882**	**81,688**

19.4.18 Comparisons of the net change in GHG emissions for Option ST2B against the relevant UK carbon budgets and Scottish carbon reduction interim targets (i.e. 2030 and 2040) are summarised in Table 19.12 and Table 19.13, respectively.

19.4.19 From Table 19.12, it can be seen that the change in GHG emissions expected to result from Option ST2B, is estimated to be negligible relative to each carbon budget, accounting for approximately 0.001% of the 4th carbon and 5th carbon budgets and approximately 0.002% of the recommended 6th carbon budget.

19.4.20 The net changes in GHG emissions for the years that Scottish interim targets have been defined (i.e. 2030 and 2040) shown in Table 19.13 are equivalent to 0.040% and 0.045% of the corresponding targets, respectively, which is again considered negligible.

Table 19.12: Net Change in GHG Emissions (Option ST2B vs. Do-Minimum) Compared with Relevant UK Carbon Budgets

Emission Source	Emission Source			Change as Percentage of Relevant Carbon Budget (%)		
	4th	5th	6th	4th (1,950 $MtCO_2e$)	5th (1,725 $MtCO_2e$)	6th (965 $MtCO_2e$)
Construction	10,902	-	-	<0.001%	-	-
Operational Road Users	8,923	21,204	19,626	<0.001%	0.001%	0.002%
Total	**19,825**	**21,204**	**19,626**	**0.001%**	**0.001%**	**0.002%**

Table 19.13: Net Change in GHG Emissions (Option ST2B vs. Do-Minimum) Compared with Scottish Interim Targets

Emission Source	Net Change in GHG Emissions in Interim Target Year (tCO_2e)		Net Change in GHG emissions as Percentage of Scottish Interim Target (%)	
	2030	2040	2030 (19$MtCO_2e$)	2040 (7.6$MtCo_2e$)
Construction	3,634	-	0.019%	-
Operational road users	4,241	3,610	0.021%	0.045%
Total	**7,875**	**3,610**	**0.040%**	**0.045%**

Impacts and Effects Specific to Option ST2C

19.4.21 Estimated construction and operational road user GHG emissions for Option ST2C, split per carbon budget period, are summarised in Table 19.14.

Table 19.14: GHG Emissions for Option ST2C – Total Do-Something Emissions Per Budget Period

Emission Source	GHG Emissions distributed per Carbon Budget (tCO_2e)		
	4th (1,950 $MtCO_2e$)	5th (1,725 $MtCO_2e$)	6th (965 $MtCO_2e$)
Construction	22,202	-	-
Operational road users	34,544	84,150	80,995
Total	**56,746**	**84,150**	**80,995**

19.4.22 Comparisons of the net change in GHG emissions for Option ST2C against the relevant UK carbon budgets and Scottish carbon reduction interim targets (i.e. 2030 and 2040) are summarised in Table 19.15 and Table 19.16, respectively.

19.4.23 From Table 19.15, it can be seen that the change in GHG emissions expected to result from Option ST2C, is estimated to be negligible relative to each carbon budget, accounting for <0.002% of the 4th carbon budget, approximately 0.001% of the 5th carbon budget and approximately 0.002% of the recommended 6th carbon budget.

19.4.24 The net changes in GHG emissions for the years that Scottish interim targets have been defined (i.e. 2030 and 2040) shown in Table 19.16 are equivalent to 0.059% and 0.045% of the corresponding targets, respectively, which is again considered negligible.

Table 19.15 Net Change in GHG Emissions (Option ST2C vs. Do-Minimum) Compared with Relevant UK Carbon Budgets

Emission Source	Emission Source			Change as Percentage of Relevant Carbon Budget (%)		
	4th	5th	6th	4th (1,950 $MtCO_2e$)	5th (1,725 $MtCO_2e$)	6th (965 $MtCO_2e$)
Construction	22,202	-	-	<0.001%	-	-
Operational Road Users	8,620	20,472	18,933	<0.001%	0.001%	0.002%
Total	**30,822**	**20,472**	**18,933**	**<0.002%**	**0.001%**	**0.002%**

Table 19.16 Net Change in GHG Emissions (Option ST2C vs. Do-Minimum) Compared with Scottish Interim Targets

Emission Source	Net Change in GHG Emissions in Interim Target Year (tCO_2e)		Net Change in GHG emissions as Percentage of Scottish Interim Target (%)	
	2030	2040	2030 (19$MtCO_2e$)	2040 (7.6$MtCo_2e$)
Construction	7,401	-	0.038%	
Operational road users	4,094	3,479	0.021%	0.045%
Total	**11,495**	**3,479**	**0.059%**	**0.045%**

Impacts and Effects Specific to Option ST2D

19.4.25 Estimated construction and operational road user GHG emissions for Option ST2D, split per carbon budget period, are summarised in Table 19.17.

Table 19.17: GHG Emissions for Option ST2D – Total Do-Something Emissions Per Budget Period

Emission Source	GHG Emissions distributed per Carbon Budget (tCO_2e)		
	4th (1,950 $MtCO_2e$)	5th (1,725 $MtCO_2e$)	6th (965 $MtCO_2e$)
Construction	2,973	-	-
Operational road users	34,276	83,557	80,508
Total	**37,249**	**83,557**	**80,508**

19.4.26 Comparisons of the net change in GHG emissions for Option ST2D against the relevant UK carbon budgets and Scottish carbon reduction interim targets (i.e. 2030 and 2040) are summarised in Table 19.18 and Table 19.19, respectively.

19.4.27 From Table 19.18, it can be seen that the change in GHG emissions expected to result from Option ST2D, is estimated to be negligible relative to each carbon budget, accounting for <0.001% of the 4th carbon budget, approximately 0.001% of the 5th carbon budget and approximately 0.002% of the recommended 6th carbon budget.

19.4.28 The net changes in GHG emissions for the years that Scottish interim targets have been defined (i.e. 2030 and 2040) shown in Table 19.19 are equivalent to 0.037% and 0.045% of the corresponding targets, respectively, which is again considered negligible.

Table 19.18: Net Change in GHG Emissions (Option ST2D vs. Do-Minimum) Compared with Relevant UK Carbon Budgets

Emission Source	Emission Source			Change as Percentage of Relevant Carbon Budget (%)		
	4th	5th	6th	4th (1,950 $MtCO_2e$)	5th (1,725 $MtCO_2e$)	6th (965 $MtCO_2e$)
Construction	2,973	-	-	<0.001%	-	-
Operational Road Users	8,352	19,878	18,446	<0.001%	0.001%	0.002%
Total	**11,325**	**19,878**	**18,446**	**<0.001%**	**0.001%**	**0.002%**

Table 19.19: Net Change in GHG Emissions (Option ST2D vs. Do-Minimum) Compared with Scottish Interim Targets

Emission Source	Net Change in GHG Emissions in Interim Target Year (tCO_2e)		Net Change in GHG emissions as Percentage of Scottish Interim Target (%)	
	2030	2040	2030 (19$MtCO_2e$)	2040 (7.6$MtCo_2e$)
Construction	991	-	0.016%	-
Operational road users	3,976	3,403	0.021%	0.045%
Total	**4,967**	**3,403**	**0.037%**	**0.045%**

19.5 Potential Mitigation

19.5.1 For the DMRB Stage 2 assessment, the design has not been sufficiently developed to allow the mitigation measures to be defined in detail. The objective of this section is to identify potential mitigation taking into account best practice, legislation and guidance, which would be further developed and refined during the DMRB Stage 3 assessment. Table 19.20 lists potential mitigation measures.

19.5.2 DMRB LA 114 states that projects should seek to minimise GHG emissions in all cases to contribute to the UK's target for a net reduction in carbon emissions. Reporting and guidance, such as the Infrastructure Carbon Review (UK Government, 2013) and PAS 2080:2016 (BSI, 2016) indicate that the potential to influence GHG emissions decreases as a project progresses. The largest savings can be achieved during the design stage, with more modest reductions being achievable during design and construction. Taking cognisance of early interventions in route option selection can allow for consideration of likely emissions and make this a key differentiator when determining a Preferred Route Option.

19.5.3 Taking this into consideration, the key early intervention procedures, as identified in the Infrastructure Carbon Review (HM Treasury, 2013) can be considered to be:

- avoid and/or eliminate or 'build nothing': challenge the need; explore alternative approaches to achieve the desired outcome
- reduce or 'build less': maximise the use of existing assets, optimise asset operation and management to reduce the extent of new construction required
- substitute, replace or 'build clever': design in the use of low carbon materials, streamline the delivery process, minimise resource consumption
- compensate or 'build efficiently': embrace new construction technologies, eliminate waste.

Table 19.20: Potential mitigation measures

Project activity	Potential impacts	Description of mitigation measures	How measures would be implemented
Construction material	Embodied emissions	▪ Implement avoid/reduce principles in the use of GHG intensive materials and processes. ▪ Set our contractor requirements with standards for substitution/replacement of GHG intensive materials. ▪ Alternatives to primary aggregates should be investigated at DMRB Stage 3, including opportunities to reuse materials from the other A9 dualling projects or major development sites in the study area. ▪ Minimise distances over which materials and wastes are transported	▪ Contract documents ▪ Construction Environmental Management Plan ▪ Materials procurement register/ invoices/ certifications records ▪ Materials Management Plans (where required) ▪ Site Waste Management Plan ▪ Weighbridge records/ waste transfer notes/ consignment notes

19.6 Summary of Route Options Assessment

19.6.1 This section provides a summary of the DMRB Stage 2 assessment of potential impacts for the proposed route options taking into account the anticipated mitigation as described in Section 19.5. Professional judgement has been used to assess the potential impact and the differences between the proposed route options which are summarised in Table 19.21.

19.6.2 For the comparison of proposed route options, two aspects are considered; whether the potential for any residual effects would be considered significant in the context of the EIA Regulations, and whether any of the potential impacts and effects identified differ sufficiently between proposed route options such that they can be considered a differentiator and need to be considered as part of the overall identification of the Preferred Route Option which, as explained in Volume 1, Part 3 – Environmental Assessment (Chapter 7: Overview of Environmental Assessment), takes into account environmental, engineering, economic and traffic considerations.

Construction

<u>Imported Materials</u>

19.6.3 It is anticipated that Option ST2C would have the highest impact on GHG emissions from earthworks as it has the highest requirement for import of earthworks compared to the other proposed route options which do not require any imported earthwork materials. The import of high volumes of earthworks to site is a carbon intensive process due to the need for a large number of vehicle movements to transport fill material to the construction site.

19.6.4 Options ST2A, ST2B and STCD would result in similar emissions from imported pavement aggregates, with the proposed route options estimated to result 5,525 tCO_2e, 5,619 tCO_2e and 5,853 tCO_2e respectively. Option ST2D is estimated as having the lowest impact on emissions at 562 tCO_2e.

Structures

19.6.5 Based on overall comparative cost estimates for structures, Option ST2D has the lowest potential effect on GHG emissions, with Option ST2A having the greatest potential effect. All proposed route options have more than 10 separate structures that are proposed to be constructed. There is a small variation between the number of bridges and culverts for the proposed route options. However, Option ST2A includes a 1.5km long cut and cover tunnel, which would require more materials and resource to build.

19.6.6 Option ST2C would be the second most materially intensive option as it has six retaining walls in comparison to two across the other proposed route options as well as a pedestrian underpass. Option ST2B has a 150m vehicle underpass, whereas Option ST2D has a pedestrian underpass, and therefore overall has the lowest number of structures to be built and the lowest potential impact.

Earthworks Materials Surplus/Disposal

19.6.7 Option ST2A is estimated to have the greatest impact on GHG emissions from removal of earthworks at 10,386 tCO_2e. This is due to the inclusion of a 1.5km cut and cover tunnel and the subsequent large quantity of excess soil material that would need be removed from site. Option ST2B has the next highest impact on earthwork removal GHG emissions at 5,283 tCO_2e with options ST2C and ST2D having a similar impact at 2,143 tCO_2e and 2,411 tCO_2e respectively.

Operation

19.6.8 In line with DMRB LA 114, and based on professional judgement, the changes in operational road user GHG emissions for the operation stage of each of the proposed route options considered are likely to have an adverse effect on climate. However, the magnitude of the changes in GHG emissions associated with each of the proposed route options is considered to be negligible when compared with UK carbon budgets and Scottish Government interim targets. Therefore, it is not expected that any of the proposed route options will materially hinder the Scottish or UK Governments from meeting their legislative carbon reduction targets. As such no significant residual effects are identified. It is acknowledged, however, that no formal guidance is provided within DMRB LA 114 on what relative increase in GHG emissions as a result of a proposed scheme could be considered to result in a 'material impact'.

Table 19.21: Summary of Assessment – Climate

Chapter/Subcategory			Residual Effects				Comments
			Option ST2A	Option ST2B	Option ST2C	Option ST2D	
Climate	Construction	Earthworks import	0 tCO_2e	0 tCO_2e	14,206 tCO_2e (Highest)	0 tCO_2e	Option ST2C would result in the highest GHG emissions from earthworks import due to movement on site and transportation. The other proposed route options are able to re-use site won material, negating the need to import earthwork materials and therefore have no earthworks import related GHG emissions. Option ST2C is therefore assessed as having the highest effect on emissions. The differences in emissions arising from earthworks import between the proposed route options is considered sufficient to be a differentiator.
		Materials import – pavement	5,525 tCO_2e (3rd Highest)	5,619 tCO_2e (2nd Highest)	5,853 tCO_2e (Highest)	562 tCO_2e (Lowest)	Options ST2A, ST2B and ST2C would have similar emissions from the use of pavement aggregates. Option ST2D would have the lowest effect on emissions from pavement aggregates. The differences in emissions arising from materials import (pavement) between the proposed route options is considered sufficient to be a differentiator.
		Materials import – structures	13 structures, including 1.5km tunnel (Highest)	14 structures (3rd Highest)	16 structures (2nd Highest)	13 structures (Lowest)	All proposed route options include a number of new structures. Although Option ST2C has the largest number of new structures, it is Option ST2A which is likely to have the highest effect on GHG emissions due to the construction of the 1.5km cut and cover tunnel. Option ST2D has the lowest number of structures and is considered to have the lowest effect on GHG emissions. The differences in emissions arising from materials import (structures) between the proposed route options are considered sufficient to be a differentiator.
		Earthworks export	10,386 tCO_2e (Highest)	5,283 tCO_2e (2nd Highest)	2,143 tCO_2e (Lowest)	2,411 tCO_2e (3rd Highest)	Option ST2C has the lowest effect on GHG emissions from earthworks export, whereas Option ST2A has the greatest effect. Option ST2A requires six times more disposal of earthworks when compared to Option ST2C. The differences in emissions arising from earthworks export between the proposed route options is considered sufficient to be a differentiator.
	Operation	Road users (over 60-year appraisal period)	210,515 tCO_2e (3rd Highest)	220,365 tCO_2e (Highest)	212,427 tCO_2e (2nd Highest)	207,609 tCO_2e (Lowest)	The estimated net change in road user GHG emissions as a result of each option are considered to be broadly similar in magnitude and considered not sufficient to differentiate between the proposed route options.

Compliance Against Plans and Policies

19.6.9 DMRB LA 104 (Highways et al., 2020) states that environmental assessment, reporting and monitoring shall meet the requirements of the national planning policy for each relevant Overseeing Organisation.

19.6.10 *Appendix A21.1 (Assessment of Policy Compliance)* provides a review of national, regional and local policy documents which are of relevance to this assessment undertaken and reported in this chapter in accordance with DMRB guidance.

19.6.11 National Planning Policy objectives (and accompanying best practice guidance) of relevance to this assessment are provided in National Planning Framework 3 (Scottish Government, 2014a), Scottish Planning Policy (SPP) (Scottish Government, 2014b; Revised 2020) theme *Sustainability*, as well as The Environment Strategy for Scotland (Scottish Government, 2020), Climate Change Plan – The Third Report on Proposals and Policies 2018-2032 (Scottish Government, 2018) and Climate Ready Scotland: Second Scottish Climate Change Adaptation Programme 2019-2024 (Scottish Government, 2019). In addition, local policies of relevance include Perth and Kinross Local Development Plan 2 (PKC LDP2) (PKC 2019) Policies 1 (Placemaking) and 57 (Air Quality) as well as TAYplan Policies 2 (Shaping Better Quality Places) and 7 (Energy, Waste and Resources).

19.6.12 A full policy compliance assessment can be found in Table 11 of *Appendix A21.1 (Assessment of Policy Compliance)*. Overall, the design and assessment of the proposed route options has had regard to policy objectives to minimise effects on climate. While it is anticipated that the proposed route options will result in an increase in GHG emissions during construction, when compared with relevant UK carbon budgets and Scottish carbon reduction targets no significant effect is assessed in relation to climate. As such, the proposed route options are expected to comply with national policy objectives on climate.

Community Objectives

19.6.13 There are no specific contributions to meeting the community objectives identified for Climate. Further details on contributions to the community objectives from other environmental factors are detailed in *Appendix A7.1 (Mapping of Community Objectives Against DMRB Stage 2 Route Options)* and the relevant chapters within Volume 1, Part 3 – Environmental Assessment of this DMRB Stage 2 Report.

Comparative Assessment

19.6.14 The differences between potential impacts and effects on climate during construction are considered sufficient to be a differentiator between proposed route options. It is considered that Option ST2A would have the highest overall effect during construction (predominantly due to emissions associated with the construction of the 1.5km cut and cover tunnel). Options ST2B and ST2C are expected to have intermediate effects and Option ST2D is anticipated to have the lowest overall effect on climate, as shown in Table 19.23.

Table 19.23: Climate Comparative Assessment - Construction

Route Option	Lowest Overall Effect	Intermediate Overall Effect	Highest Overall Effect
Option ST2A			✓
Option ST2B		✓	
Option ST2C		✓	
Option ST2D	✓		

19.6.15 Each of the proposed route options are expected to result in increases in operational road user GHG emissions of similar magnitude (which are considered to be not significant). As such, the effects of each of the proposed route options on operational road user GHG emissions are not considered to be a differentiator.

19.7 Scope of Stage 3 Assessment

19.7.1 It is proposed that the DMRB Stage 3 assessment for Climate would be undertaken in accordance with Highways England *et al* (2020) 'DMRB LA 114 Climate' which is the published Sustainability and Environment Appraisal standard for this factor.

19.7.2 Further detailed assessment, at DMRB Stage 3, would build on the information reported in this DMRB Stage 2 Environmental Assessment by collating additional data to gain an in-depth appreciation of changes in GHG emissions, as well as the vulnerability of the Preferred Route Option taken forward to potential future changes in climate.

19.7.3 It would also enable the identification of the key environmental impacts and the significance of effect associated with climate; and identify the measures which could be implemented to mitigate the impacts and effects.

19.8 References

Legislation

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20. Human Health

20.1 Introduction

20.1.1 This chapter presents the Design Manual for Roads and Bridges (DMRB) Stage 2 assessment of the potential impacts and effects of each of the proposed route options on human health.

20.1.2 The World Health Organisation (WHO) (1995) defines human health as '*a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity*'. For the purposes of this assessment, human health is considered to encompass both physical and mental health.

20.1.3 Although there is no statutory requirement for 'wellbeing' to be assessed, this aspect has been included in the scope of this human health assessment in response to concerns raised by the Birnam to Ballinluig A9 Community Group during the A9 Co-Creative Process that the A9 Dualling Programme: Pass of Birnam to Tay Crossing project would affect their general wellbeing.

20.1.4 The notion of wellbeing encompasses not just how happy people are on a day-to-day basis, but also includes much broader concepts such as *'how satisfied people are with their lives on the whole, their sense of purpose, and how in control they feel'* (Mental Health Foundation, 2019).

20.1.5 The assessment follows DMRB guidance of the effects of proposed trunk road schemes on human health, following publication of DMRB LA 112 'Population and human health' (Highways England et al., 2020a) (hereafter referred to as DMRB LA 112). At an early stage of the A9 Co-Creative Process the Birnam to Ballinluig A9 Community Group generated a set of community objectives and where these directly relate to wellbeing, they have been utilised to inform this assessment. Therefore, the human health assessment is developed further beyond that outlined in DMRB LA 112 in order to also consider the potential impacts and effects on wellbeing.

20.1.6 This chapter focuses on the potential for impacts and effects on both human health and wellbeing in relation to determinants, such as those illustrated in Diagram 20.1. Human health and wellbeing determinants are the range of personal, social, economic and environmental factors which determine the health status of individuals or populations. Human health and wellbeing determinants are then used to assess likely human health and wellbeing outcomes.

Diagram 20.1: Determinants of Health and Wellbeing (Barton and Grant, 2010)

Legislative and Policy Background

20.1.7 This section provides an overview of the relevant national, regional and local planning policies and guidance for human health and wellbeing.

20.1.8 An assessment of the compliance of the proposed scheme against all planning policies and plans relevant to this environmental topic is reported in Volume 1, Part 3 – Environmental Assessment (Chapter 21: Policies and Plans) and *Appendix A21.1 (Assessment of Policy Compliance).*

Scotland's National Performance Framework

20.1.9 In June 2018, the Scottish Parliament introduced the National Performance Framework (NPF), which sets out the vision for national wellbeing in Scotland across a range of economic, social and environmental factors. The NPF sets out 11 'national outcomes', illustrated on Diagram 20.2, which align with the United Nations Sustainable Development Goals. In relation to health, the outcomes are as follows:

- grow up loved, safe and respected so that they realise their full potential
- people live in communities that are inclusive, empowered, resilient and safe;
- people value, enjoy, protect and enhance their environment;
- people are healthy and active; and

- people are creative and their vibrant and diverse cultures are expressed and enjoyed widely.

20.1.10 The NPF national indicators have been utilised in this assessment as a framework against which to measure how the proposed scheme could affect health and wellbeing. This approach is described further in Section 2 (Approach and Methods).

Diagram 20.2: Scotland's National Performance Framework – Our Purpose, Values and National Outcomes (Scottish Government, 2019)

Scotland's National Transport Strategy (2020)

20.1.11 Scotland's second National Transport Strategy (NTS2) was published in 2020 and sets out the vision for the country's transport system, underpinned by four priorities each with three associated outcomes, to be at the heart of decision-making. One of the priorities and associated outcomes is specifically related to health and wellbeing, as follows:

- ***'Improves our health and wellbeing***
  - *Will be safe and secure for all*
  - *Will enable us to make healthy travel choices*
  - *Will help make our communities great places to live.'* (Transport Scotland, 2020)

20.1.12 NTS2 identifies safety as a priority for the transport system as road incidents can have a significant negative effect on society, with those living in deprived areas being worst affected. Rural areas are also highlighted as a key area for improving safety due to the challenges associated with the more poorly maintained footpath networks and roads.

20.1.13 NTS2 sets out that active travel is one of the most effective ways to secure the required 30 minutes of moderate activity per day to reduce obesity and other health issue related to inactivity. NTS2 highlights the importance of children learning healthy behaviours such as walking or cycling when they are at a young age.

Perth & Kinross Council Local Development Plan 2 2019

20.1.14 The Perth and Kinross Local Development Plan 2 (LDP2) sets out the overall spatial planning policy for the local authority area. The following policies are related to human health and wellbeing determinants:

- **Policy 56: Noise Pollution.** '*There will be a presumption against the siting of development proposals which will generate high levels of noise in the locality of existing or proposed noise sensitive land uses and similarly against the locating of noise sensitive uses near to sources of noise generation.*' (p.91, Perth & Kinross Council, 2019)
- **Policy 57: Air Quality**. '*The Council has a responsibility to improve air quality. The LDP does this by seeking to prevent the creation of new pollution hotspots, and to prevent introduction of new human exposure where there could be existing poor air quality…. Any proposed development that could have a detrimental effect on air quality, through exacerbation of existing air quality issues or introduction of new sources of pollution (including dust and/or odour), must provide appropriate mitigation measures. The LDP expects that some type of mitigation of air quality effects will be required for all but the smallest developments. Best practice design measures should therefore be considered early in the design and placemaking process… Proposals and mitigation measures must not conflict with the actions proposed in Air Quality Action Plans.*' (p.92, Perth & Kinross Council, 2019)
- **Policy 58A: Contaminated Land.** *'The Council's first priority will be to prevent the creation of new contamination. Consideration will be given to proposals for the development of contaminated land, as defined under Part IIA, Section 78A(2) of the Environmental Protection Act 1990, where it can be demonstrated to the satisfaction of the Council that appropriate remediation measures can be incorporated in order to ensure the site/land is suitable for the proposed use and in order to ensure that contamination does not adversely affect the integrity of a European designated site(s)'.* (p.95, Perth & Kinross Council, 2019)

TAYplan Strategic Development Plan (2016 – 2036)

20.1.15 The TAYplan Strategic Development Plan (2016 – 2036) sets the overall planning vision for the next 20 years for the whole Dundee and Perth area, including Perth and Kinross.

20.1.16 One of the four outcomes of the plan is that '*more people are healthier.*' The following policies in TAYplan are relevant to health:

- **Policy 2: Shaping Better Quality Places.** '*Policy 2 advocates lifetime communities. These are places that support independent living for all people throughout their lives. Typically they provide a range of homes, services and facilities that are easily accessible to all. This will also include active travel routes and supporting infrastructure, as well as open space and sport and recreational facilities. It may also include the co-location of health and social care facilities. As such lifetime communities support active and healthy lifestyles and reduce the need to travel. They also contribute to improving life opportunities to access jobs, services and facilities through active travel. Lifetime communities should be embedded into the location, design and layout of development at the outset.*' (p.15, TAYplan, 2017).

- **Policy 4: Homes.** *'Community, healthcare education and sporting facilities are best located at the heart of the communities they serve. This may mean that they form part of local centres or other hubs.'* (p.31, TAYplan, 2017).
- **Policy 8: Green Networks.** *'The TAYplan area is made up of numerous networks of green space within and between settlements. These are integral to achieving the vision for better quality places and healthier lives… The intention is that improved access to stronger and healthier green networks enriches our health and wellbeing. This can also help provide good quality places where people want to live, work and invest.'* (p.48, TAYplan, 2017).
- **Policy 10: Connecting People, Places and Markets.** *'Good connectivity within and through the area is important to Scotland's economy because TAYplan lies between the central belt and the Highlands and Aberdeen/North East Scotland. This is to provide better access to jobs, services and facilities in order to help reduce disparities, enhance economic competitiveness and improve quality of life. It is also part of the health and low carbon agenda to protect/provide for infrastructure that facilitates modal shift, reduces the need to travel and reduces carbon emissions and air pollution.'* (p.58, TAYplan, 2017).

20.2 Approach and Methods

Scope

20.2.1 The human health and wellbeing assessment has considered the potential impacts and effects of each of the proposed route options, for each health and wellbeing determinant, during construction and operation. This has allowed the identification of differences and potential differentiators between proposed route options.

20.2.2 This section sets out the approach and methods for the DMRB Stage 2 human health assessment, providing information relating to the following processes:

- identification of relevant health and wellbeing determinants using DMRB LA 112 'Population and Human Health' guidance and NPF indicators;
- identification of community objectives related to health and wellbeing;
- utilisation of data sources (i.e. DMRB Stage 2 environmental factor chapters); and
- results of literature reviews which describe potential health sources and pathways for determinants.

Health and Wellbeing Determinants

20.2.3 A change to a single health determinant can affect the health status of different individuals or communities depending on their characteristics and sensitivity to change, thereby influencing multiple health outcomes.

20.2.4 The human health assessment has considered the health determinants outlined in DMRB LA 112 and broadens this to also consider the NPF indicators, which include a range of factors attributed to wellbeing. It was considered that mapping the NPF indicators would be an appropriate means to identify any additional determinants related to wellbeing not included in DMRB LA 112. For the purposes of this assessment, the DMRB LA 112 health determinants and NPF wellbeing indicators are referred to collectively as 'health and wellbeing determinants.'

<u>DMRB LA 112 Population and Human Health</u>

20.2.5 Health determinants set out in DMRB LA 112 that are relevant to the proposed route options are as follows:

- air quality management areas and ambient air quality;
- landscape amenity;
- sources and pathways of potential pollution;
- areas recognised as being sensitive to noise and the ambient noise environment;
- community, recreational and education facilities and severance/separation of communities from such facilities;
- green/open space and severance/separation of communities from such facilities;
- healthcare facilities and severance/separation of communities from such facilities;
- transport network and usage in the area, including the surrounding road network, Public Rights of Way (including bridleways), cycle ways, non-designated public routes and public transport routes; and
- safety information associated with the existing affected road network.

National Performance Framework Wellbeing Indicators

20.2.6 The NPF measures Scotland's progress against the national outcomes by using 'national indicators'. These indicators give a measure of national wellbeing and include a range of economic, social and environmental indicators. An individual's wellbeing can be influenced by environmental, social, and cultural factors, in addition to their economic success. The 11 national outcomes are shown in Diagram 20.1 each falling under a different category. These are underpinned by performance indicators to allow progress to be measured. Annual performance data are published on the Scottish Government website (Scottish Government, n.d).

20.2.7 There are a range of performance indicators that are used to measure performance against each of the national outcomes. The NPF indicators allow a comparison to be made between what is considered an important component of wellbeing at a national level, and the factors outlined by the communities in their list of objectives (refer to Table 20.1). The indicators are therefore considered in the context of the wellbeing of the communities of Dunkeld, Birnam, Inver and the surrounding area. Some of the 11 national outcomes are considered more relevant in determining the wellbeing of the community than others, and four categories comprising: communities; culture; environment; children; and health have been identified as being particularly pertinent to the wellbeing related community objectives that were identified during the A9 Co-Creative Process and detailed in Table 20.1 Those considered relevant to wellbeing in the context of the proposed route options have been taken forward to the assessment.

20.2.8 Progress against the NPF indicators is measured periodically by the Scottish Government. While the NPF indicators are used in this assessment as a guide, this assessment does not attempt to measure changes in wellbeing using the same parameters as the NPF. Indicators deemed relevant to the context of the proposed route options are instead measured against the data gathered for the DMRB Stage 2 environmental assessment, as outlined in Table 20.1.

DMRB Stage 2 Assessments

20.2.9 The following relevant DMRB Stage 2 environmental factors have been used to support the identification of potential changes to health and wellbeing determinants as a result of the proposed route options:

- Volume 1, Part 2 - Engineering Assessment, in relation to road traffic accidents and driver stress.
- Volume 1, Part 3 – Environmental Assessment:
  - Chapter 8 (Population – Land Use);

- Chapter 9 (Geology, Soils and Groundwater);
- Chapter 12 (Landscape);
- Chapter 13 (Visual);
- Chapter 14 (Cultural Heritage);
- Chapter 15 (Air Quality);
- Chapter 16 (Noise and Vibration); and
- Chapter 17 (Population – Accessibility).

Birnam to Ballinluig A9 Community Group Community Objectives

20.2.10 The community objectives described in full in Volume 1, Part 3 – Environmental Assessment (Chapter 7: Overview of Environmental Assessment, Table 7.2) have been considered throughout DMRB Stage 2. As part of this human health and wellbeing assessment the community objectives related to health and wellbeing (highlighted yellow in Table 20.1) were measured against the health and wellbeing determinants to identify where the proposed route options have the potential to have a positive or negative influence on the determinants during the operational phase.

Table 20.1: Birnam to Ballinluig A9 Community Group Community Objectives

Community Objectives	
Community Objective 1	*Reduce current levels of noise and pollution in the villages of Dunkeld, Birnam and Inver to **protect human health and wellbeing of residents and visitors** and to enable them to peacefully enjoy their properties and amenity spaces.*
Community Objective 2	Protect and enhance the scenic beauty and natural heritage of the area and its distinctive character and quality.
Community Objective 3	*Provide better, safer access on and off the A9 from both sides of the road while ensuring easy, safe movement of vehicular traffic and NMUs[1] through the villages, **helping to reduce stress and anxiety** and support the local community.*
Community Objective 4	Promote long-term and sustainable economic growth within Dunkeld and Birnam and the surrounding communities.
Community Objective 5	*Examine and identify opportunities to enhance the levels of cycling and walking for transport and leisure, including the improvement of existing footpaths and cycle ways, to **promote positive mental health and wellbeing**.*
Community Objective 6	Ensure that all local bus, intercity bus services and train services are maintained and improved.
Community Objective 7	*Preserve and enhance the integrity of the unique and rich historical and cultural features of the Dunkeld, Birnam and Inver communities, thereby **supporting wellbeing** and the local economy.*

Literature Review of Health Pathways

20.2.11 In order for there to be a likely potential health effect, a health pathway must be established. A health pathway is referred to as '*the plausibility of a causal relationship*' (IEMA, 2017) i.e. the plausibility of a project generating a potential health effect.

20.2.12 A literature review has been undertaken to determine an association between changes that are likely to occur due to the proposed route options in relation to the health and wellbeing determinants, and the

[1] Non Motorised Users (NMUs) in this DMRB Stage 2 assessment are referred to as Walkers, Cyclists and Horse-riders (WCH) in accordance with DMRB LA 112.

resulting potential changes to health and wellbeing outcomes. The results of the literature review and relevant health and wellbeing pathways are provided in Table 20.2.

Table 20.2: Description of pathway in relation to health and wellbeing determinants

Health and wellbeing determinant	Health and wellbeing pathway
Air quality management areas and ambient air quality	Poor air quality can result in human health conditions such as asthma, respiratory problems and cardiovascular disease (Royal College of Physicians, 2016). Children and elderly individuals are more susceptible than the general population to air pollution (Zhang et al, 2016). Human exposure to particulate matter and nitrogen dioxide can have adverse health effects. There is no proven safe threshold at which human health is not at risk from particulate matter. For nitrogen dioxide, there is believed to be a threshold at which there is a risk to human health.
Landscape amenity	The association between pleasant landscapes and relaxation has a growing evidence base. Access to good-quality landscapes has positive effects peoples' health and wellbeing, while a lack of access tends to have a negative effect. According to the Landscape Institute (n.d. p.1), '*areas of social and economic deprivation, often linked with poorer health and reduced life expectancy, can also be associated with limited access to good-quality green space.'* Adverse landscape amenity effects can discourage communities and individuals from accessing and using areas of open space. This can result in reduced physical activity and have negative effects on mental health (Croucher et al., 2007). Landscape amenity is concerned with: ▪ the opportunities available to people to enjoy publicly accessible locations (such as playing fields, parks and common land); and ▪ with the pleasantness of the landscape as a setting for peoples' day to day activities. Landscape amenity does not just relate to views and visual amenity but encompasses the experience of all five senses.
Sources and pathways of potential pollution	The WHO states that contaminated land *'might threaten human health and the environment, by altering air quality, hampering soil functions, and polluting groundwater and surface water.'* Ground gases, unexploded ordnance (UXO) and pollution of ground and surface water can result in personal injury (WHO, 2012a). For the assessment of contaminated land, contamination levels must be substantially below the relevant General Assessment Criteria (GAC) in order to present no risk to human health. People have the potential to be affected by pollutants through pathways such as ingestion, inhalation and dermal contact with soils, soil dust, deep and shallow groundwater and surface water, or by migration of ground gases into confined spaces.
Areas recognised as being sensitive to noise and the ambient noise environment	According to WHO (2018) '*Environmental noise is a threat to public health, having negative effects on human health and well-being'.* High levels of noise nuisance and vibration caused by traffic and construction activities can result in sleep disturbance, increased aggression, impaired communication (WHO, 1995). After air pollution, noise is cited by the European Environment Agency as the second most significant environmental risk with exposure to environmental noise causing 12,000 premature deaths annually and contributing to 48,000 new cases of ischaemic heart disease (EEA, n.d). The transport network is often cited as the most widespread source of noise. For road traffic, noise and vibration effects are measured against the Significant Observed Adverse Effect Level (SOAEL), the threshold above which significant adverse effects on health and quality of life could occur. Health effects associated with noise are likely to disproportionately affect certain vulnerable members of society including those with pre-existing conditions, children, the elderly and poorer communities.

Health and wellbeing determinant	Health and wellbeing pathway
Community, recreational and education facilities and severance/separation of communities from such facilities	Access to public services and social infrastructure is a key determinant of health and wellbeing (NHS, 2013). Access to green and open space is important for health and wellbeing in a number of ways. It has been suggested that contacts with nature can trigger positive effects for persons with high stress levels, improve functioning of the immune system, as well as encouraging enhanced physical activity and improved fitness (Braubach et al, 2017). As stated by the WHO (2020), *'Regular physical activity is proven to help prevent and manage noncommunicable diseases such as heart disease, stroke, diabetes and several cancers. It also helps prevent hypertension, maintain healthy body weight and can improve mental health, quality of life and well-being.'* Adults are recommended to do at least 150 – 300 minutes of moderate intensity physical activity across the week, while children are recommended to do an average of 60 minutes per day of moderate to vigorous intensity (WHO, 2020). Severance to core/local paths or transport networks as a result of the proposed route options has the potential to impede access to community, recreational and educational facilities, green/open space, and healthcare facilities. Severance from these open space and community facilities can result in reduced social cohesion and physical activity and have negative effects on mental health (Croucher et al., 2007). For the purposes of this assessment, cultural heritage assets are considered as community, recreational and education facilities. Cultural heritage assets are important community resources. According to a literature review undertaken by What Works Wellbeing (2019), there is '*evidence that heritage visiting may improve a wide range of wellbeing-related outcomes, including social cohesion, the urban environment, community identity, social connectivity and cohesion, sense of belonging, sense of place, enjoyment, satisfaction, confidence, and learning, and provide opportunities for 'escape'/respite and recuperation (Bryson et al., 2002; Everett & Barrett, 2011; Packer, 2008).'*
Green/open space and severance/separation of communities from such facilities	
Healthcare facilities and severance/separation of communities from such facilities	
Transport network and usage in the area, including the surrounding road network, Public Rights of Way (including bridleways), cycle ways, non-designated public routes and public transport routes	Changes to traffic movements and flows can result in severance, accidents and driver stress. Severance to core/local paths or transport networks as a result of the proposed route options has the potential to impede access to community, recreational and educational facilities, green/open space, and healthcare facilities. Severance from these open space and community facilities can result in reduced social cohesion and physical activity and have negative effects on mental health (Croucher et al., 2007). In Scotland in 2018 there were a total of 8,402 road casualties reported, of which 160 were fatalities and 1,581 were seriously injured (Transport Scotland, 2018). According to WHO (2021) *'More than half of all road traffic deaths and injuries involve vulnerable road users, such as pedestrians, cyclists and motorcyclists and their passengers. In addition to the human suffering caused by road traffic injuries, they also incur a heavy economic burden on victims and their families, both through treatment costs for the injured and through loss of productivity of those killed or disabled.'*
Safety information associated with the existing affected road network	

Mapping Health and Wellbeing Determinants

20.2.13 Using professional judgement, it was determined that four out of the seven community objectives outlined in Table 20.1 are relevant to health and wellbeing. The four objectives relevant to health and wellbeing have been mapped against the DMRB Stage 2 assessment topic areas (refer to *Appendix A7.1: Mapping of Community Objectives Against DMRB Stage 2 Route Options*). This mapping has been further developed to also encompass the associated health and wellbeing determinants from DMRB LA 112 and NPF. The results of the mapping exercise is reported in Table 20.3. The NPF outcome category for each of the indicators is denoted by (H) for Health, (C) for Communities, (E) for Environment, (Cu) for Culture, and (Ch) for Children.

20.2.14 While not included as a specific health determinant in DMRB LA 112 guidance, indicators relating to culture form part of the NPF outcomes, and culture is also recognised by the community objectives as being an important component of community wellbeing. Output from the DMRB Stage 2 cultural heritage assessment has therefore been considered in this chapter, in relation to access to cultural heritage assets as a community resource. The likely health and wellbeing outcomes from changes to access to cultural heritage assets are assessed under the *'Community, recreational and education facilities and severance/ separation of communities from such facilities'* determinant. The link between cultural heritage and wellbeing is discussed in Table 20.2.

20.2.15 It is also recognised that effects on biodiversity and nature sites, both NPF indicators, are likely to arise from the proposed route options. The amenity benefits that humans derive from nature are assessed under the determinants relating to access to green/open space and landscape amenity.

Table 20.3: Mapping of Community Objectives, DMRB LA 112 Health Determinants and National Performance Framework Indicators

Community Objective	DMRB Stage 2 Assessment Topic Area and Relevant DMRB LA 112 Health Determinants	National Performance Framework Indicator
Community Objective 1: Reduce current levels of noise and pollution in the villages of Dunkeld, Birnam and Inver to **protect human health and wellbeing of residents and visitors** and to enable them to peacefully enjoy their properties and amenity spaces.	Geology, Soils and Groundwater (Chapter 9) ▪ Sources and pathways of potential pollution.	▪ Healthy life expectancy (H) ▪ Premature mortality (H) ▪ Child wellbeing and happiness (Ch)
	Air Quality (Chapter 15) ▪ Air quality management areas and ambient air quality.	▪ Healthy life expectancy (H) ▪ Mental wellbeing (H) ▪ Premature mortality (H) ▪ Visits to the outdoors (E) ▪ Child wellbeing and happiness (Ch)
	Noise and Vibration (Chapter 16) ▪ Areas recognised as being sensitive to noise and the ambient noise environment.	▪ Healthy life expectancy (H) ▪ Mental wellbeing (H) ▪ Premature mortality (H) ▪ Visits to the outdoors (E) ▪ Child wellbeing and happiness (Ch)
	Population – Land Use (Chapter 8) ▪ Green/open space and severance/separation of communities from such facilities.	▪ Mental wellbeing (H) ▪ Access to green and blue space (C) ▪ Visits to the outdoors (E) ▪ Child wellbeing and happiness (Ch)
Community Objective 3: Provide better, safer access on and off the A9 from both sides of the road while ensuring easy, safe movement of vehicular traffic and Walkers, Cyclists and Horse-riders (WCH) through the villages, helping to **reduce stress and anxiety** and support the local community.	Population - Accessibility (Chapter 17) ▪ Outline spatial characteristics of the transport network and usage in the area, including the surrounding road network, Public Rights of Way (including bridleways), cycle ways, non-designated public routes and public transport routes. Volume 1, Part 4 – Traffic and Economic Assessment ▪ Safety information associated with the existing affected road network.	▪ Healthy life expectancy (H) ▪ Mental wellbeing (H) ▪ Journeys by active travel (H) ▪ Premature mortality (H) ▪ Physical activity (H) ▪ Visits to the outdoors (E) ▪ Child wellbeing and happiness (Ch)
	Population – Land Use (Chapter 8)	▪ Healthy life expectancy (H) ▪ Physical activity (H)

Community Objective	DMRB Stage 2 Assessment Topic Area and Relevant DMRB LA 112 Health Determinants	National Performance Framework Indicator
	▪ Community, recreational and education facilities and severance/separation of communities from such facilities.	▪ Mental wellbeing (H) ▪ Places to interact (C) ▪ Child wellbeing and happiness (Ch)
	Population – Land Use (Chapter 8) ▪ Healthcare facilities and severance/separation of communities from such facilities.	▪ Healthy life expectancy (H) ▪ Mental wellbeing (H) ▪ Premature mortality (H) ▪ Child wellbeing and happiness (Ch)
Community Objective 5: Examine and identify opportunities to enhance the levels of cycling and walking for transport and leisure, including the improvement of existing footpaths and cycle ways, to **promote positive mental health and wellbeing.**	Population - Accessibility (Chapter 17) ▪ Outline spatial characteristics of the transport network and usage in the area, including the surrounding road network, Public Rights of Way (including bridleways), cycle ways, non-designated public routes and public transport routes.	▪ Mental wellbeing (H) ▪ Journeys by active travel (H) ▪ Premature mortality (H) ▪ Physical activity (H) ▪ Visits to the outdoors (E) ▪ Child wellbeing and happiness (Ch)
	Volume 1, Part 4 – Traffic and Economic Assessment Population - Accessibility (Chapter 17) ▪ Safety information associated with the existing affected road network.	▪ Healthy life expectancy (H) ▪ Mental wellbeing (H) ▪ Premature mortality (H) ▪ Child wellbeing and happiness (Ch)
	Landscape (Chapter 12) and Visual (Chapter 13) ▪ Landscape amenity.	▪ Mental wellbeing (H) ▪ Physical activity (H) ▪ Journeys by active travel (H) ▪ Access to green and blue space (C) ▪ Visits to the outdoors (E) ▪ Child wellbeing and happiness (Ch)
Community Objective 7: Preserve and enhance the integrity of the unique and rich historical and cultural features of the Dunkeld, Birnam and Inver communities, thereby **supporting wellbeing** and the local economy.	Chapter 14 (Cultural Heritage) ▪ Community, recreational and education facilities and severance/separation of communities from such facilities.	▪ Attendance at cultural events or places of culture (Cu) ▪ Participation in a cultural activity (Cu) ▪ Places to interact (C) ▪ Visits to the outdoors (E) ▪ State of historic sites (E) ▪ Child wellbeing and happiness (Ch)

Study Area

20.2.16 The study area of the assessment is focused on the communities of Dunkeld, Little Dunkeld, Birnam and Inver as these are the communities in proximity to the proposed route options that have potential to be directly or indirectly affected by the dualling of the A9 between Pass of Birnam and Tay Crossing. The location of these communities in relation to the proposed route options is shown on Image 20.1. However, it is recognised that there are smaller settlements – such as Dalmarnock and Dalguise - and residences in the wider area that may access community, education, and healthcare facilities within Dunkeld, Little Dunkeld, Birnam and Inver and these will also be considered in the assessment where

relevant. For the purposes of the assessment, the settlements and residences with the potential to be impacted by the proposed route options are referred to collectively as 'the communities'.

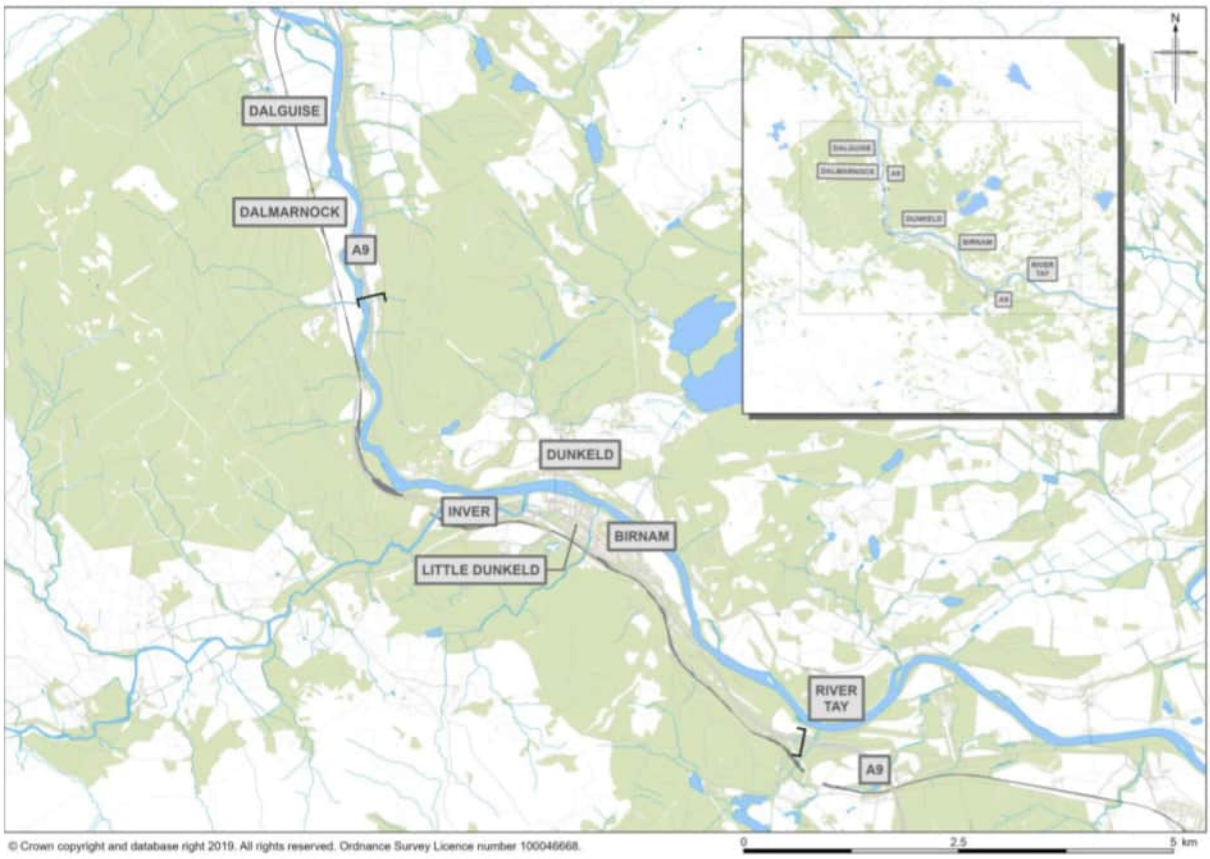

Image 20.1: Main communities in the study area

Baseline Conditions

Desk-based Assessment

20.2.17 To establish the health and wellbeing profile of the communities, baseline data has been gathered from the following sources:

- Office for National Statistics (ONS);
- Scotland's Census (2011) area profiles;
- Scottish Index of Multiple Deprivation (SIMD) 2020;
- The Scottish Public Health Observatory (ScotPHO);
- Scottish Government website; and
- local council data and information (Perth & Kinross Council).

20.2.18 The baseline presented in this chapter is concerned solely with the human health profile of the communities. Environmental baseline information in relation to the health and wellbeing determinants (e.g. existing noise and vibration levels) is provided in the related DMRB Stage 2 environmental topic assessment chapters and Volume 1, Part 4 – Traffic and Economic Assessment outlined in Table 20.3, and for brevity this information is not repeated in this chapter.

Consultation

20.2.19 As described in Volume 1, Part 3 – Environmental Assessment (Chapter 7: Overview of Environmental Assessment, Table 7.2), consultation was undertaken with the Birnam to Ballinluig A9 Community Group as part of the A9 Co-Creative Process and this generated a set of community objectives for the project, some of which relate to wellbeing and so are directly relevant to this assessment. The notion of 'wellbeing' has been included within the scope of the DMRB Stage 2 human health assessment, and the community objectives have been utilised to inform the identification of likely health outcomes that would likely occur as a result of the proposed route options.

Impact Assessment

20.2.20 The likely health and wellbeing outcomes for construction and operational stages of the proposed route options are assessed and reported separately within this chapter. Differences in the approach to the assessment for construction and operation stages are explained in paragraphs 20.2.29 and 20.2.30.

Sensitivity

20.2.21 Relevant data have been gathered on human physical, mental, and social health and wellbeing of the communities of Dunkeld, Little Dunkeld, Birnam and Inver, through a combination of desktop research and consultations, where possible, to provide context and understanding of the local community and likely health wellbeing issues they may encounter. This data has been used as evidence to establish an overall health profile of the communities.

20.2.22 Criteria for sensitivity is not provided in DMRB LA 112 but has been developed using professional judgement for the purposes of this assessment, as detailed in Table 20.4.

Table 20.4: Criteria Used for Assigning Sensitivity

Sensitivity	Criteria
Low	Category not generally assigned in human health assessment. Category not considered appropriate for human health assessment given the sensitivity of communities and vulnerable groups to changes in their environment.
Medium	Category assigned to communities with an average* or above average* health profile relating to the following factors: life expectancy, general health, mental health, income deprivation and other factors as outlined in DMRB LA 112 Section 3.25.
High	Category assigned to communities with a below-average* health profile relating to one or more of the following factors: life expectancy, general health, mental health, income deprivation and other factors as outlined in DMRB LA 112 Section 3.25.
Very High	Category assigned to community, or sub-group of a community, considered to be particularly vulnerable and/or sensitive to change. Examples include: children, the elderly, people with disabilities, and people living in the most deprived SIMD data zones.

*When compared to local authority/national data, depending on the scale and characteristics of the project and the data available.

20.2.23 It is considered that human receptors are generally sensitive to change and using the precautionary approach, the majority of communities are likely to come under either the medium or high category. Therefore, an additional category of very high has been added to the sensitivity categories provided in DMRB LA 112, for communities or sub-groups deemed to be particularly sensitive.

Mitigation

20.2.24 Examples of potential mitigation measures related to health and wellbeing are detailed in the relevant DMRB Stage 2 environmental chapters and are not repeated in this chapter. Examples of health and

wellbeing potential mitigation measures that would be considered at DMRB Stage 3 following identification of the Preferred Route Option are outlined in Section 20.5 (Potential Mitigation).

Significance

20.2.25 No specific magnitude criteria for human health and wellbeing were applied beyond what is identified for individual environmental factor assessments (e.g. noise and vibration). Rather, this human health and wellbeing assessment has drawn on the mitigated position (residual effects) of the environmental factor assessments reported in other chapters of this DMRB Stage 2 environmental assessment.

20.2.26 The assessment reported in this chapter is qualitative in nature, drawing on output from the other technical chapters as outlined in Table 20.3. The potential residual effects reported in the other environmental factor assessments have been considered, including identified differentiators, and these have been assessed in turn against the health and wellbeing determinants and community objectives, where applicable. Professional judgement has been used to determine how changes to health and wellbeing determinants that are likely to occur as a result of the proposed route options would likely affect health and wellbeing outcomes, considering the sensitivity of the communities.

20.2.27 The likely health outcome category is identified in accordance with Table 20.4, and as contained in DMRB LA 112. For the purposes of this assessment, the likely health outcome categories identified in DMRB LA 112 have also been applied to wellbeing with the wording of the health outcome description amended accordingly.

Table 20.4: Human health and wellbeing outcome categories

Human health and wellbeing outcome category	Human health and wellbeing outcome description
Positive	A beneficial health and wellbeing impact is identified
Neutral	No discernible health and wellbeing impact is identified
Negative	An adverse health and wellbeing impact is identified
Uncertain	Where uncertainty exists as to the overall health and wellbeing impact

20.2.28 Where a change in health and wellbeing determinants or health and wellbeing outcome is expected for vulnerable groups and this is different to that assessed for other groups, this has been reported in the assessment.

20.2.29 For the purposes of this DMRB Stage 2 human health and wellbeing assessment it is considered that there is the potential for a significant effect on human health and wellbeing where the likely human health and wellbeing outcome is assessed as Positive or Negative, and not significant where the likely human health and wellbeing outcome is assessed as Neutral. Where the likely human health and wellbeing outcome is assessed as Uncertain, it is unknown if there is a potentially significant effect.

20.2.30 For the assessment of effects during construction, changes in health and wellbeing determinants are considered across the four proposed route options taking into account the sensitivity of the communities and potentially vulnerable groups. The likely health and wellbeing outcome for the communities is reported for each determinant and proposed route option.

20.2.31 For the assessment of effects during operation, changes in health and wellbeing determinants are considered across the four proposed route options and an objectives-based approach is adopted, focused on the four community objectives related to health and wellbeing presented in Table 20.1. Due to the level of community engagement in the development of the proposed route options and their

concerns related to wellbeing it was considered this was an appropriate means through which to approach the assessment of the proposed route options for the topic of health and wellbeing.

20.2.32 The assessment is recorded in tables in Section 20.4 (Potential Impacts and Effects) and effects on health and wellbeing are assessed during construction and up to year 15 of operation.[2]

Limitations to Assessment

20.2.33 It should be noted that this DMRB Stage 2 assessment was prepared prior to and during the global COVID-19 coronavirus pandemic. Throughout 2020 and in early 2021, there have been significant and extensive restrictions in place in Scotland on the movement of people and the activities that are permitted. At the time of undertaking the assessment, the full implications on the physical and mental health and wellbeing of communities in the study area as a result of the pandemic are not yet known. This assessment does not take into account either direct or indirect impacts of COVID-19 in the health baseline, nor does it incorporate potential COVID-19 impacts in the future baseline.

20.2.34 The health profile created for the communities has largely been based on data collection from secondary data sources. Whilst this search has provided general information on the communities and vulnerable groups along the proposed route options, the data gathered is at a high-level and not all specific cases have been captured, in part due to the extent of the boundaries of the census data zones used. The health profile baseline provides context, and the impact assessment approach is qualitative and at the population level.

20.2.35 The assessment of effects on health and wellbeing is reliant on data gathered from assessments of other environmental factors in this DMRB Stage 2 assessment. At this stage of the assessment, potential residual effects are reported and there is a degree of uncertainty due to the early stages of design development. The significance of effects in the relevant assessments and the resulting human health and wellbeing outcome would be further assessed at DMRB Stage 3.

20.3 Baseline Conditions

Overview

20.3.1 For the purposes of establishing the health and wellbeing profile, the communities of Birnam, Little Dunkeld, Dunkeld, and Inver were grouped together as an overarching settlement of Dunkeld and Birnam to align with the 2011 census data zones. The health profile for Dunkeld and Birnam is considered to be representative of the wider area and the settlements and residences that may access facilities in the villages.

20.3.2 In the 2011 Scottish Census, the population of the local area in the settlement of Dunkeld and Birnam was 1,287 accounting for approximately 0.8% of the wider population of Perth and Kinross (146,652). Infants and children aged 0 – 15 years old encompass 16% of the total population of Dunkeld and Birnam. This percentage is slightly lower than the national equivalent of 17%. The percentage of those aged 65 years or older is 25% (Scotland's Census, 2011).

20.3.3 As illustrated in Table 20.5, the median age of the population in Dunkeld and Birnam is higher than the national median.

[2] Fifteen years following scheme opening year is the point at which potential operational effects are measured as by this time mitigation measures such as landscape and ecological planting would be reasonably established.

Table 20.5: Median age in Dunkeld and Birnam compared to Scotland overall (Scotland's Census, 2011)

Sex	Median Age	
	Dunkeld and Birnam	Scotland
Females	51	42
Males	45	40

General Health

20.3.4 The majority of the population of Dunkeld and Birnam stated their health was good or very good (84%) in the 2011 census, compared to 82% in Scotland overall. Additionally, 22% of the population of Dunkeld and Birnam would describe themselves as limited by a health problem or disability in some capacity, higher than the average for Scotland at 20% (Scotland's Census, 2011).

20.3.5 Table 20.6 shows the long-term health conditions experienced by the settlements in comparison to that of Scotland.

Table 20.6: Long-term health conditions of Dunkeld and Birnam compared to Scotland (Scotland's Census, 2011)

Long-Term Health Condition	Dunkeld and Birnam	Scotland
% With no condition	65.9%	70.1%
% With one or more long-term health conditions	34.1%	29.9%
% With deafness or partial hearing loss	9.5%	6.6%
% With blindness or partial sight loss	2.6%	2.4%
% With learning disability (for example, Down's Syndrome)	0.1%	0.5%
% With learning difficulty (for example, dyslexia)	1.9%	2.0%
% With developmental disorder (for example, Autistic Spectrum Disorder, Asperger's Syndrome)	0.6%	0.6%
% With physical disability	7.2%	6.7%
% With mental health condition	2.6%	4.4%
% With other condition	23.6%	18.7%

20.3.6 As Table 20.6 shows, residents of Dunkeld and Birnam are more likely to suffer from a long-term health condition in comparison to Scotland as a whole, with a difference of approximately 4%. Additionally, there are a higher proportion of people with a physical disability in Dunkeld and Birnam (7.2%) when compared to the proportion in Scotland overall (6.7%). Some of the conditions in Table 20.6 are commonly developed in old age, such as hearing and sight loss, thus the higher proportions may be attributed to an aging population within the community.

20.3.7 Conversely, the data in Table 20.6 shows that the percentage of the population with a mental health condition is almost 2% lower than the national average, suggesting that residents of Dunkeld and Birnam on the whole experience better mental health than the average Scottish person.

20.3.8 Causes of death from respiratory problems (influenza, pneumonia, chronic obstructive pulmonary disease (COPD) and asthma, in 2019, across the whole of Scotland, accounted for 5,092 deaths (approximately 8.8% of total deaths in Scotland). Causes of death from respiratory problems in Perth

and Kinross accounted for 188 deaths (approximately 3.7% of deaths in Perth and Kinross). These data illustrate that respiratory illness is a less common cause of death in Perth and Kinross than in Scotland. There is no further information available at a more localised scale, and the records for 2020 are yet to be released at the time of writing.

20.3.9 Furthermore, within the 'Luncarty and Dunkeld' data zone, for chronic obstructive pulmonary disease (COPD) hospitalisations, the area performs better than the comparator (Scotland overall) at 111.9 per 100,000 vs 277.4 per 100,000 (2017/18-2019/20). Asthma patient hospitalisations are lower than the comparator at 82.8 per 100,000 vs 89.6 per 100,000 (2017/18-2019/20) (ScotPHO, 2021).

Vulnerable Groups

20.3.10 There are some groups in the settlements of Dunkeld and Birnam that could be considered as vulnerable (young people including school children, the elderly and people with disabilities) and therefore more sensitive to changes in the environment that may affect their health and wellbeing.

20.3.11 It has been determined by the desk-study of statistical data that the population of the settlements of Dunkeld and Birnam are of an older demographic than the population of Scotland as a whole. According to the 2011 census, the average age of the settlement of Dunkeld and Birnam is 46 with 55% of the population aged 45 years or older. The average age for Scotland is 40, with 44% aged 45 years or older.

20.3.12 Residents of Dunkeld and Birnam have poorer health in general than Scotland overall, with a higher percentage of people suffering from long-term health conditions or disabilities than the national average.

20.3.13 Children aged 0–15 years old encompass 16% of the population of Dunkeld and Birnam, and there is a local primary school in Dunkeld. The Royal School of Dunkeld serves a wide catchment area of Birnam, Dunkeld, Amulree, Glen Quaich, Dowally, Kincraigie and Butterstone, and has seven primary classes and a nursery.

Personal Wellbeing Indicators

20.3.14 The Office for National Statistics (ONS) undertakes annual surveys into personal wellbeing, based on data from the Annual Population Survey, which includes responses from around 165,000 people. This provides a large representative sample of adults aged 16 and over living in residential households in the UK.

20.3.15 The four questions asked are:

- Overall, how satisfied are you with your life nowadays?
- Overall, to what extent do you feel the things you do in your life are worthwhile?
- Overall, how happy did you feel yesterday?
- Overall, how anxious did you feel yesterday?

20.3.16 Respondents are asked to give their answers on a scale of 0 to 10, where 0 is 'not at all' and 10 is 'completely'. These questions allow people to make an assessment of their life overall, as well as providing an indication of their day-to-day emotions. Although 'yesterday' may not be a typical day for an individual, the large sample means that these differences 'average out' and provide a reliable assessment of the self-reported anxiety and happiness of the adult population in the UK over the year.

20.3.17 It is important to remember that the findings presented are based on survey estimates and are subject to a degree of uncertainty. They should therefore be interpreted as providing a good estimate, rather than an exact measure of personal wellbeing in the UK.

20.3.18 Results of the survey are presented on a UK-level, country-level, and local authority-level. The results of the survey respondents from the Perth & Kinross Council (PKC) area for the four questions listed above for the years 2015 – 2020 are shown in Table 20.7, and how these compare to the average for Scotland.

Table 20.7: Personal wellbeing indicators – Perth and Kinross, 2015 – 2020 (ONS, 2020)

Personal Wellbeing Indicator	Perth and Kinross					Scotland Average (2019 – 2020)	Difference[3]
	2015 - 2016	2016 - 2017	2017 - 2018	2018 - 2019	2019 - 2020		
Life satisfaction	7.85	7.93	7.82	7.89	7.83	7.68	+0.15
Worthwhile	7.91	7.95	7.97	7.95	7.97	7.86	+0.11
Happiness	7.60	7.78	7.70	7.84	7.55	7.43	+0.12
Anxiety[4]	2.81	2.69	2.53	2.66	3.06	3.12	-0.06

20.3.19 The ONS wellbeing survey data shows that overall, those in the Perth & Kinross local authority area, which encompasses the settlements of Dunkeld and Birnam, experience higher levels of life-satisfaction and happiness and sense of feeling worthwhile, and lower levels of anxiety than the Scottish population as a whole. However, the data show that levels of anxiety for people living in Perth & Kinross has increased between 2018-2019 and 2019-2020. The ONS survey data was gathered between April 2019 and March 2020 and it is uncertain the extent to which peoples' concerns in relation to the Covid-19 pandemic has been captured in the survey data, but if included this could help to explain the rise in anxiety levels in Perth & Kinross and the wider population over this time period. The increase in anxiety levels in Perth & Kinross reflects the general increase across the population of Scotland as a whole and remains slightly below the national average. From the other three indicators, can be deduced that residents in Perth & Kinross generally feel well and are content, and this has remained relatively stable since 2015.

Scottish Index of Multiple Deprivation

20.3.20 The Scottish Index of Multiple Deprivation (SIMD) identifies areas of multiple deprivation across all of Scotland and ranks these areas from most deprived (ranked 1) to least deprived (ranked 6,976). None of the communities identified within the study area (Dunkeld, Little Dunkeld, Birnam, and Inver) are listed in the top 20% of multiple deprivation (Scottish Government, 2020a).

20.3.21 Dunkeld and Birnam are located across two data zones (S01012007 being an area to the north and east and S01012008 being an area to the south and west) within the SIMD Decile of 'Luncarty and Dunkeld', as shown on Image 20.2.

20.3.22 In the Luncarty and Dunkeld decile, life expectancy at birth for a male is 76.5 and for a female is 81.4. This is comparatively higher than the life expectancy for Scotland overall, which for males is 74.9 and for females is 79.4.

20.3.23 SIMD statistics show that these areas are considered to be among the 6th and 7th least deprived areas in Scotland, ranking at 4,777 and 4,000 out of 6,976 local authority jurisdictions. This ranking is derived from similar ratings in areas such as 'Income', 'Employment', 'Health', 'Education', and 'Housing' and

[3] Difference between Perth and Kinross (2017 – 2018) and Scotland Average (2017 – 2018),
[4] Low score for this indicator is positive, i.e. reflects lower levels of anxiety.

shown for both data zones in Table 20.8 (Scottish Government, 2020a). The only category that Luncarty and Dunkeld do not have a higher than then average SIMD ranking for is geographical access, due to the limited public transport available and reliance on the A9 trunk road.

Table 20.8: SIMD (2020) ratings for Luncarty and Dunkeld

Data Zone	Rank							
	Overall	Income	Employment	Health	Education	Housing	Geographical Access	Crime
S01012007	7th	6th	7th	7th	8th	7th	4th	10th
S01012008	6th	7th	6th	8th	8th	5th	2nd	7th

20.3.24 The most deprived 20% of data zones tend to be located in cities, and the nearest to the Luncarty and Dunkeld in the PKC areas are in Perth itself. The SIMD data shows, overall, that Luncarty and Dunkeld are relatively affluent and successful areas in comparison to the majority of Scotland, with extremely low crime rates and higher than average rates of health, education, income, employment, housing security and income.

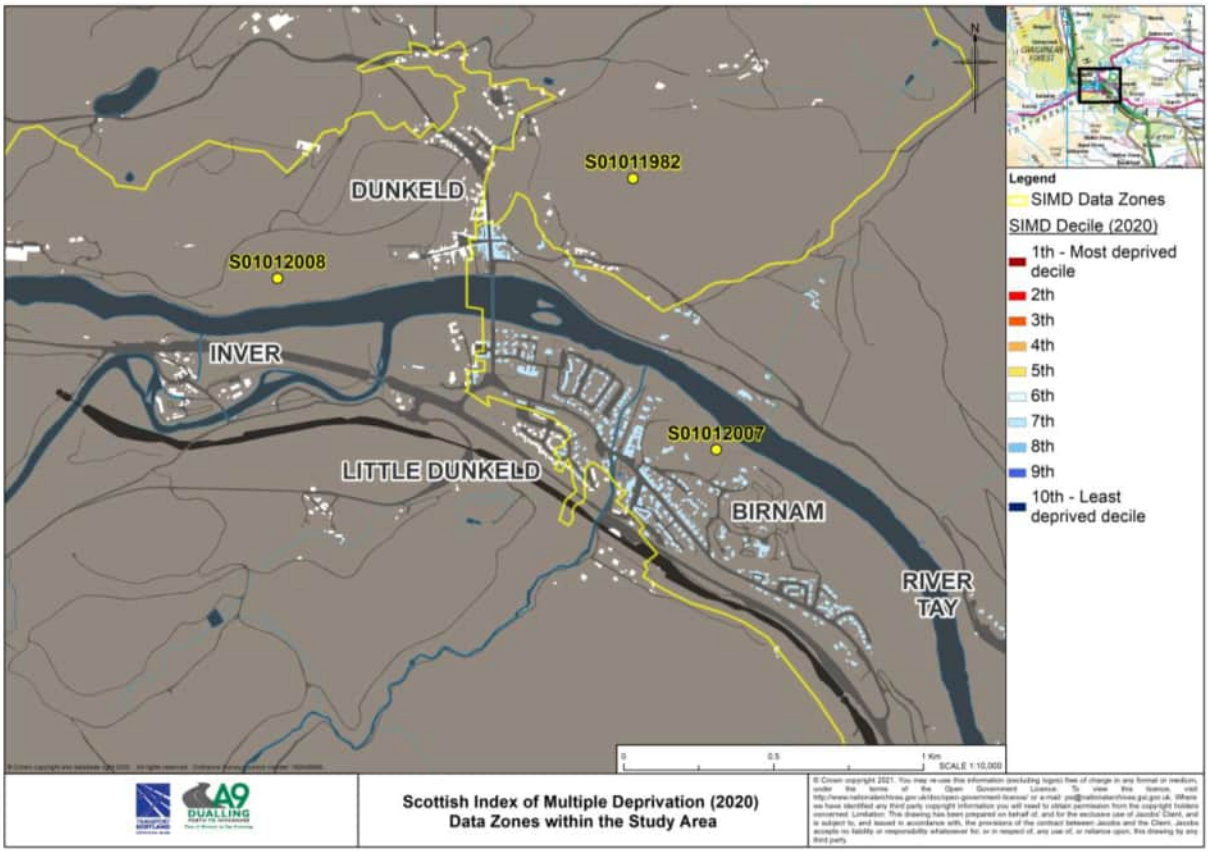

Image 20.2a: SIMD data zones within the study area (SIMD, 2020a)

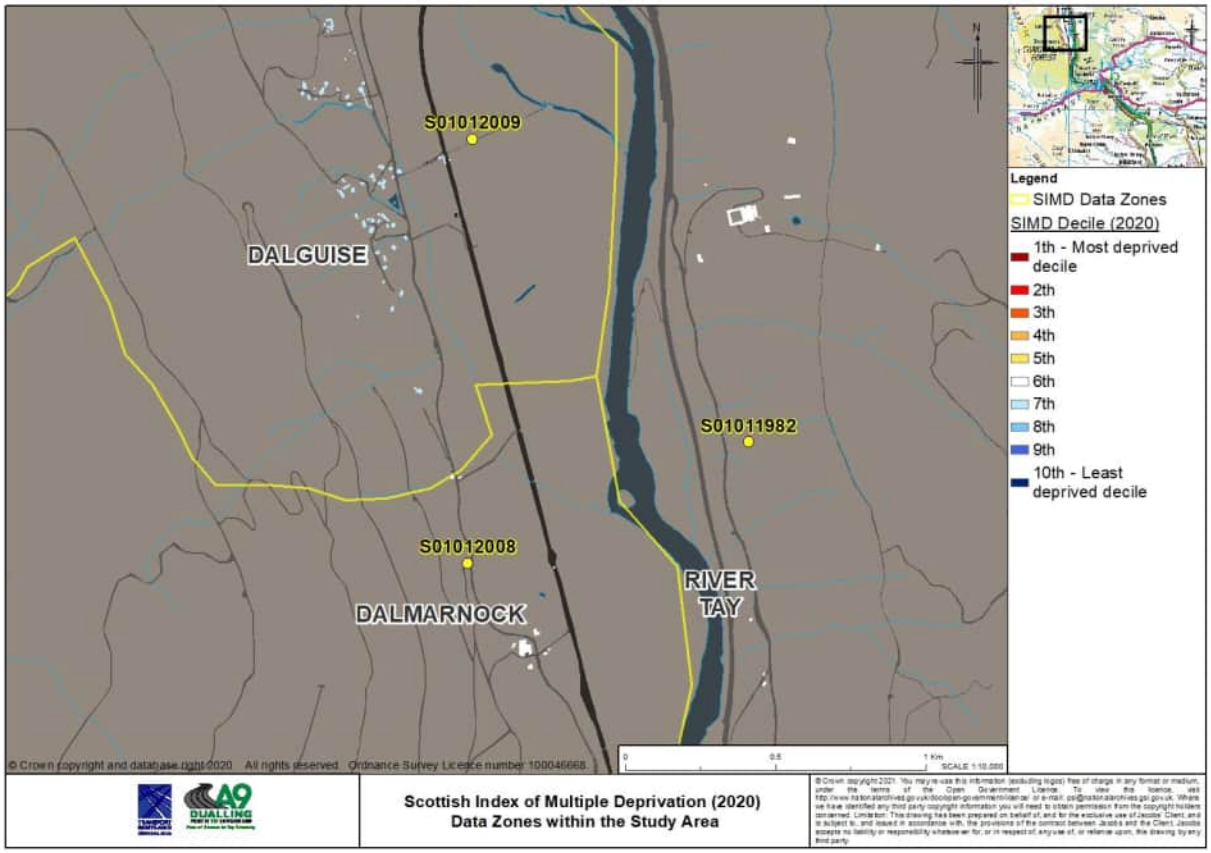

Image 20.2b: SIMD data zones within the study area (SIMD, 2020a)

Health and Wellbeing Profile of Local Communities

20.3.25 Dunkeld, Little Dunkeld, Birnam and Inver have a small population (0.8% of Perth and Kinross) with a median age higher than that of the Scottish population. There is a high proportion of residents that belong to what are termed as vulnerable groups (young people including school children, the elderly and people with disabilities).

20.3.26 Health is considered to be good or very good, similar to the average for Scotland, but there is a slightly higher proportion than those in the wider Scottish population, that consider themselves as limited by a health problem or disability in some capacity. It is possible to surmise that this is linked to the higher median age in the local population.

20.3.27 Personal wellbeing indicators suggest that the local population should have higher life satisfaction, a feeling of worthwhileness, and happiness as compared with the wider Scottish population. Levels of anxiety have risen between 2018-2019 to 2019-2020 but remain below the national average.

20.3.28 The health and wellbeing sensitivity of the communities has been determined using professional judgement, taking into account and balancing the various factors that make up the health and wellbeing profile of the area. Due to the relatively high standard of health and wellbeing in the communities as measured against the national average the overall health and wellbeing sensitivity of the communities in the study area is reported as medium. However, it is recognised that there are vulnerable groups of very high sensitivity within the communities – young people, the elderly, and people with disabilities - and these groups will be considered separately.

20.4 Potential Impacts and Effects

Introduction

20.4.1 This section provides the health and wellbeing assessment for each route option for construction and operation, in Table 20.9 and Tables 20.10 – 20.13 respectively. The related health and wellbeing determinants are assessed using information gathered from the DMRB Stage 2 environmental chapters and Volume 1, Part 4 – Traffic and Economic Assessment and as outlined in Table 20.3. For the assessment of effects during operation, changes in health and wellbeing determinants are considered across the four proposed route options focused on the four community objectives related to health and wellbeing presented in Table 20.1. The assessment draws on the residual effects identified in the environmental chapter, i.e., after likely mitigation measures have been applied. Comments are provided where there are differentiators between proposed route options in relation to health and wellbeing determinants and whether there is a likely effect on health and wellbeing outcomes, taking into account the sensitivity of the communities.

20.4.2 The NPF indicator 'child wellbeing and happiness' is considered relevant to every health and wellbeing determinant due to the potential for young people to be more sensitive to changes in their environment. Health inequalities can emerge or worsen during childhood and develop into continuing health problems and inequalities in adulthood (World Health Organisation, 2012b). Where an effect is anticipated to arise, which could lead to a different likely health and wellbeing outcome for young people, this is explicitly stated, otherwise it is assumed that effects on young people would be similar to those of the communities as a whole.

Table 20.9: Construction – Potential Effects on Health and Wellbeing Determinants and Likely Health Outcomes

DMRB LA 112 Health Determinant	NPF Indicators	Residual Effects (post-mitigation) reported in DMRB Stage 2 Environmental Factor Assessments				Health and Wellbeing Determinants and Likely Health and Wellbeing Outcome
		Option ST2A	Option ST2B	Option ST2C	Option ST2D	
Air quality management areas and ambient air quality	Healthy life expectancy (H) Premature mortality (H) Mental wellbeing (H) Visits to the outdoors (E) Child wellbeing and happiness (Ch)	Chapter 15 (Air Quality) People within 50m of the principal dust generating activities (e.g. site clearance, topsoil strip; cutting and filling, handling and placing of road base materials and aggregates and landscaping) and downwind of the prevailing south-west winds would be those potentially at greatest risk of nuisance associated with construction-related dust. Potential effects on air quality related to construction traffic would be considered in more detail at DMRB Stage 3 for the Preferred Route Option. Although there are some differences between proposed route options in terms of number and types of air quality effects during construction, these effects are not considered significant as the pollutant concentrations at all assessed human health receptors are below the objective values set to protect human health.				There is no material difference between the proposed route options for this determinant, and pollutant concentrations during construction are anticipated to be below the objective values set to protect human health, as reported in Volume 1, Part 3 – Environmental Assessment (Chapter 15: Air Quality). None of the proposed route options are considered to influence premature mortality or life expectancy or affect visits to the outdoors as a result of air pollution. A likely Neutral health and wellbeing outcome is anticipated for the communities during construction from changes to air quality and the related NPF indicators for all proposed route options.
Landscape amenity	Mental wellbeing (H) Physical activity (H) Journeys by active travel (H) Access to green and blue space (C) Visits to the outdoors (E) Child wellbeing and happiness (Ch)	Chapter 12 (Landscape) and Chapter 13 (Visual) The construction activities associated with road schemes generally cause temporary adverse landscape and visual effects. All the proposed route options are likely to result in potential effects on the landscape resource during construction as a result of activities including (but not limited to): ▪ removal of roadside woodland and scrub vegetation; ▪ loss of embankments and rock outcrops; ▪ vehicles moving machinery and materials to and from the site; ▪ machinery, potentially including heavy excavators and earth-moving plant; ▪ exposed bare earth over the extent of the proposed works; and ▪ structures, earthworks, road surfacing and ancillary works during construction. In general terms the most significant adverse landscape effects during the construction period are likely to occur when major structures such as bridges, retaining walls and/or junctions and the associated earthworks are being erected or carried out.				For landscape, effects during construction would be broadly similar for all proposed route options, despite the differences in the duration of the impacts. Effects would be largely reversible, so are not considered sufficient to be a differentiator, as reported in Volume 1, Part 3 – Environmental Assessment (Chapter 12: Landscape and Chapter 13: Visual). Physical activity, visits to the outdoors, use of green space, and journeys by active travel may reduce as a result of the potential effects on landscape and visual amenity value of the WCH routes. In turn, this may lead to a potential adverse effect on physical health and mental wellbeing. A likely temporary Negative health and wellbeing outcome is anticipated for the communities during construction from changes to landscape and visual amenity and the related NPF indicators for all proposed route options, but particularly for Options ST2A and ST2B which have the longest construction duration.
		The construction phase has an	The construction phase has an estimated	The construction phase has an	The construction phase has an estimated duration of 2.5 to 3 years.	

DMRB LA 112 Health Determinant	NPF Indicators	Residual Effects (post-mitigation) reported in DMRB Stage 2 Environmental Factor Assessments				Health and Wellbeing Determinants and Likely Health and Wellbeing Outcome
		Option ST2A	Option ST2B	Option ST2C	Option ST2D	
		estimated duration of 4.5 to 5 years. Highest overall effects due to large scale and prolonged construction operations required to construct the cut and cover tunnel. Additional effects from construction of Murthly Junction.	duration of 4 to 4.5 years. Highest overall effects with exception of Option ST2A during construction due to the large-scale operations required to construct the 150m underpass. Additional effects from construction of grade separated Birnam Junction.	estimated duration of 2.5 to 3 years. Intermediate overall effects during construction due to the construction of the junctions entailing soil nailing, retaining walls and large-scale earthworks. Additional effects from construction of grade separated Birnam Junction.	Lowest overall effects during construction due to the realigned route being mostly online. Additional effects from construction of grade separated Birnam Junction.	
Sources and pathways of potential pollution	Healthy life expectancy (H) Premature mortality (H) Child wellbeing and happiness (Ch)	<u>Chapter 9 (Geology, Soils and Groundwater)</u> Direct disturbance of identified potential contaminated land sources is expected for all proposed route options. This interaction could lead to direct and indirect potential effects to human health and the water environment. There are no differentiators in terms of effect significance post mitigation. Where significant contamination is confirmed, a risk assessment would be undertaken as part of the DMRB Stage 3 assessment; and mitigation, if required, would be specified on a site-specific basis.				For all proposed route options, it is expected that potential effects during construction on human health from contaminated land would be mitigated through appropriate risk assessments. There are no differentiators in terms of effect significance post mitigation, as reported in Volume 1, Part 3 – Environmental Assessment (Chapter 9: Geology, Soils and Groundwater). None of the proposed route options are considered to influence premature mortality or life expectancy through exposure to pollution from contaminated land. A likely Neutral health and wellbeing outcome is anticipated for the communities during construction from potential pollution from contaminated land the related NPF indicators for all proposed route options.

DMRB LA 112 Health Determinant	NPF Indicators	Residual Effects (post-mitigation) reported in DMRB Stage 2 Environmental Factor Assessments				Health and Wellbeing Determinants and Likely Health and Wellbeing Outcome
		Option ST2A	Option ST2B	Option ST2C	Option ST2D	
Areas recognised as being sensitive to noise and the ambient noise environment	Healthy life expectancy (H) Premature mortality (H) Mental wellbeing (H) Visits to the outdoors (E) Child wellbeing and happiness (Ch)	<u>Chapter 16 (Noise and Vibration).</u> All proposed route options are expected to result in significant adverse noise effects during construction, with certain options expected to have greater number of potentially significant effects than others due to the nature of construction activities and/or the duration of the works.				The differences in predicted significant adverse noise effects during construction between proposed route options are considered a differentiator with Option ST2A having the greatest overall effect and Option ST2D the lowest overall effect as reported in Volume 1, Part 3 – Environmental Assessment (Chapter 16: Noise and Vibration). Noise and vibration from construction activities have the potential to cause disturbance and annoyance to residents for all proposed route options. Whilst it is not considered that this would influence premature mortality or life expectancy, Options ST2A and ST2B may affect mental health, due to the potential for an increase in stress and/or anxiety during the construction period. Changes to noise levels could also discourage people from visiting the outdoors. This is particularly due to the piling works required for Options ST2A and ST2B, as well as these proposed route options having the longest construction period. A likely temporary Negative health and wellbeing outcome is anticipated for the communities during construction from changes to the noise environment and the related NPF indicators for all proposed route options, but particularly for Options ST2A and ST2B due to the nature and longer duration of the construction activities.
		Option ST2A is considered likely to result in the greatest number of significant construction noise effects, as it is expected to have the longest duration of high noise levels at Noise Sensitive Receptor (NSR) properties, due to the construction of the cut and cover tunnel, as well as the longest overall construction duration during which noise impacts would be experienced.	Option ST2B is considered to have an intermediate number of significant construction noise effects, as it is expected to have the second longest period of high construction noise levels at NSR properties, due to the construction of the underpass, and the second longest overall construction period.	Option ST2C is considered to have an intermediate number of significant construction noise effects. No substantial piling activity is expected to be required for Option ST2C but there is likely to be increases in earthworks activities required to construct the grade separated junction at Dunkeld. For Option ST2C the duration of these impacts is expected to be less than for Options ST2A and ST2B and it is considered that there is less likelihood of potentially significant effects.	Option ST2D would have the least number of significant construction noise effects as the proposed route options would be be generally at-grade across its length and as a result, the scale of the construction works required are less than the other proposed route options. No substantial piling activities would be expected. It is considered that Option ST2D has the least likelihood of potentially significant effect.	

DMRB LA 112 Health Determinant	NPF Indicators	Residual Effects (post-mitigation) reported in DMRB Stage 2 Environmental Factor Assessments				Health and Wellbeing Determinants and Likely Health and Wellbeing Outcome
		Option ST2A	Option ST2B	Option ST2C	Option ST2D	
Green/Open Space and severance/ separation of communities from such facilities	Access to green and blue space (C) Mental wellbeing (H) Visits to the outdoors (E) Child wellbeing and happiness (Ch)	<u>Chapter 8 (Population - Land Use)</u> For changes to community land/assets during construction significance of effect is not reported in Volume 1, Part 3 – Environmental Assessment (Chapter 8: Population Land: Use), as potential impacts would only be temporary changes to WCH access. Where a temporary change in access has been identified, this has been reported in terms of a potential reduction of use of the land/asset.				The differences in impacts and effects on community land/assets (green/open space) during construction are not considered sufficiently different to be a differentiator between the proposed route options as reported in Volume 1, Part 3 – Environmental Assessment (Chapter 8: Population - Land Use). All proposed route options would result in a change in accessibility to Torwood Park and The Hermitage during construction, which are important areas of green space. Option ST2C would also impact on accessibility to Riverside Land. A potential reduction in use of green/open space may reduce physical activity and affect mental health. The nature of effects for Options ST2A and ST2B would be considered to have the greatest potential effect on health and wellbeing from severance/separation from green/open space, because the construction periods are the longest. Option ST2D is considered to have the lowest potential effect on health and wellbeing due to having the shortest construction duration. The nature of these adverse effects would have the potential to particularly affect health and wellbeing of vulnerable groups, such as the young and the elderly, as these groups have a propensity to visit the outdoors and access green/open spaces more than others. A likely temporary Negative health and wellbeing outcome is anticipated for the communities during construction, particularly for the young and the elderly, from severance/separation from green/open space and the related NPF indicators. The likely outcome would be Negative for all proposed route options but particularly for Options ST2A and ST2B due to the longer duration of the construction activities.
		Temporary change in accessibility and potential reduction in the level of use of Torwood Park and The Hermitage.	Temporary change in accessibility and potential reduction in the level of use of Torwood Park and The Hermitage.	Temporary change in accessibility and potential reduction in the level of use of Torwood Park, The Hermitage and Riverside Land.	Temporary change in accessibility and potential reduction in the level of use of Torwood Park and The Hermitage.	
Community, recreational and education	Mental wellbeing (H)	<u>Chapter 8 (Population - Land Use)</u> For changes to community land/assets during construction significance of effect is not reported in Chapter 8 (Population Land: Use), as potential impacts would only be temporary changes to WCH access. Where a				The differences in impacts and effects on community land/assets during construction are considered sufficiently different to be a differentiator between the proposed route options as reported in

DMRB LA 112 Health Determinant	NPF Indicators	Residual Effects (post-mitigation) reported in DMRB Stage 2 Environmental Factor Assessments				Health and Wellbeing Determinants and Likely Health and Wellbeing Outcome
		Option ST2A	Option ST2B	Option ST2C	Option ST2D	
facilities and severance/ separation of communities from such facilities	Healthy life expectancy (H) Physical activity (H) Places to interact (C) Child wellbeing and happiness (Ch)	temporary change in access has been identified, this has been reported in terms of a potential reduction of use of the land/asset.				Volume 1, Part 3 – Environmental Assessment (Chapter 8: Population - Land Use). Option ST2C would particularly affect Dunkeld and Birnam Recreation Club. Reduced access and use of these facilities may dissuade people from accessing health care or from undertaking physical activity. The nature of these adverse effects would have the potential to particularly affect health and wellbeing of vulnerable groups, such as the young and the elderly, as these groups have a propensity to visit these community and recreational facilities and places to interact more than others. A likely Neutral health and wellbeing outcome is anticipated for the communities during construction from severance/separation from community, recreational and education facilities and the related NPF indicators for all proposed route options. The likely outcome would be Negative for Option ST2C, particularly for the young and the elderly, due to its interaction with Dunkeld and Birnam Recreation Club.
		Footfall at Birnam Arts and Conference Centre may be affected, particularly for passing trade and tourist visitors.	Footfall at Birnam Arts and Conference Centre may be affected, particularly for passing trade and tourist visitors.	Dunkeld and Birnam Recreation Club would experience effects such as temporary change in access and potential reduction in use of the recreation club facilities. Footfall at Birnam Arts and Conference Centre may be affected, particularly for passing trade and tourist visitors.	Footfall at Birnam Arts and Conference Centre may be affected, particularly for passing trade and tourist visitors.	
Healthcare facilities and severance/ separation of communities from such facilities	Healthy life expectancy (H) Premature mortality (H) Mental wellbeing (H) Child wellbeing and happiness (Ch)	No residual effects on healthcare facilities reported.	No residual effects on healthcare facilities reported.	Craigvinean Health Centre would experience effects such as temporary change in access and potential reduction in use of the recreation club facilities.	No residual effects on healthcare facilities reported.	The differences in impacts and effects on community assets during construction are considered sufficiently different to be a differentiator between the proposed route options as reported in Volume 1, Part 3 – Environmental Assessment (Chapter 8: Population - Land Use). Option ST2C would particularly affect Craigvinean Health Centre. Reduced access and use of these facilities may dissuade people from accessing health care for physical or mental purposes. The nature of these adverse effects would have the potential to particularly affect health and wellbeing of vulnerable groups, such as the young and the elderly, as these groups have a propensity to visit these facilities more than others.

DMRB LA 112 Health Determinant	NPF Indicators	Residual Effects (post-mitigation) reported in DMRB Stage 2 Environmental Factor Assessments				Health and Wellbeing Determinants and Likely Health and Wellbeing Outcome
		Option ST2A	Option ST2B	Option ST2C	Option ST2D	
						A likely temporary Negative health and wellbeing outcome is anticipated for the communities during construction, particularly the young and the elderly, from severance/separation from healthcare facilities and the related NPF indicators for Option ST2C. The likely outcome would be Neutral for all other proposed route options.
Community, recreational and education facilities and severance/ separation of communities from such facilities *(cultural heritage assets)*	Attendance at cultural events or places of culture (Cu) Participation in a cultural activity (Cu) Places to interact (C) State of historic sites (E) Child wellbeing and happiness (Ch)	<u>Chapter 14 (Cultural Heritage)</u> Construction of all proposed route options would partially remove the public forecourt (now the car park) of Dunkeld & Birnam Station, would sever the pedestrian link between the Dunkeld & Birnam Station and Birnam from Station Road under the existing A9 via Birnam Glen, introduce noise and visual intrusion from construction activities, and reinforce the existing severance of Dunkeld and Birnam Station from Birnam. There is potential for significant effects on the Birnam Conservation Area due to construction activities and reinforcement of existing severance depending on the access option. For all proposed route options there would be land-take from Murthly Castle Inventory garden and designed landscape, reinforcement of the existing severance of Murthly Castle and Birnam from the majority of the Inventory garden and designed landscape and potential impacts on the setting of Murthly Castle designed landscape. Potential effects are predicted to be significant, but as they are common to all there is no differentiator between proposed route options.				All proposed route options would result in some beneficial and some adverse effects, with varying levels of significance, on Dunkeld & Birnam Station during construction. The difference in effects to cultural heritage assets are considered to be differentiators between the proposed route options, as reported in Volume 1, Part 3 – Environmental Assessment (Chapter 14: Cultural Heritage). All proposed route options have the potential to cause disruption to access to cultural heritage assets, which may affect attendance and participation in cultural activities, with a potential effect on overall health and wellbeing. Whilst there are differences in effects between proposed route options, all proposed route options have the potential to affect the state of historic sites, and the integrity of historical and cultural features during construction. During the construction period this could potentially reduce participation in cultural activities, attendance at places of culture, and visits to historic sites, resulting in adverse effects on social cohesion and community connectivity. Option ST2A and ST2B have the potential for these effects to last for the longest duration due to the construction period of these proposed route options. A likely temporary Negative health and wellbeing outcome is anticipated for the communities during construction from severance/separation from community, recreational and education facilities and the related NPF indicators for all proposed route

DMRB LA 112 Health Determinant	NPF Indicators	Residual Effects (post-mitigation) reported in DMRB Stage 2 Environmental Factor Assessments				Health and Wellbeing Determinants and Likely Health and Wellbeing Outcome
		Option ST2A	Option ST2B	Option ST2C	Option ST2D	
						options but particularly for Options ST2A and ST2B due to the nature and duration of the construction activities.
Transport network and usage in the area	Mental wellbeing (H) Journeys by active travel (H) Premature mortality (H) Physical activity (H) Visits to the outdoors (E) Child wellbeing and happiness (Ch)	Chapter 17 (Population - Accessibility) In general, the disruption to WCH as a result of construction activities is anticipated to be significant; however, this would be common to all proposed route options. Without mitigation WCH have the potential to be disrupted by: ▪ temporary diversions of paths, cycleways and minor roads which may increase journey times; ▪ temporary severance where construction works disrupt or deter WCH from using paths; ▪ temporary severance of existing at-grade access across roads; ▪ construction traffic on local roads which may create busier crossing points; ▪ location of site compounds could reduce accessibility for WCH using paths or recreation areas; and ▪ changes to the amenity value of the path and cycleway network due to noise, dust, and visual intrusion of the works. Mitigation to reduce construction effects would be developed and this would include path diversions, provision of new paths and mitigation such as planting and path design to improve amenity for WCH.				Construction effects on journey length and amenity value for WCH do not differ between proposed route options sufficiently to be considered differentiators, as reported in Volume 1, Part 3 – Environmental Assessment (Chapter 17: Population - Accessibility). Disruption to the path network and traffic would be appropriately managed during construction and would not be expected to result in effects on safety or influence premature mortality of WCH. All proposed route options support active travel, and paths and cycleways would be maintained during the construction period, albeit with some disruption during this period. While mitigation would be in place to limit disruption and reduction in amenity, the potential effect on WCH is anticipated to be significant across all proposed route options. Physical activity and visits to the outdoors using active travel routes may potentially reduce as a result of the disruption. Mental wellbeing may potentially be adversely affected by a decline in enjoyment while using WCH routes, due to a reduction in amenity value. Temporary disruption to WCH routes would therefore be considered to potentially affect health and wellbeing during construction, and it is considered that Option ST2A and Option ST2B would have the greatest potential effect because the construction periods are the longest. A likely temporary Negative health and wellbeing outcome is anticipated for the communities during construction from changes to the road and path network and the related NPF indicators, though particularly for Option ST2A and Option ST2B due to the duration of the construction activities.

DMRB LA 112 Health Determinant	NPF Indicators	Residual Effects (post-mitigation) reported in DMRB Stage 2 Environmental Factor Assessments				Health and Wellbeing Determinants and Likely Health and Wellbeing Outcome
		Option ST2A	Option ST2B	Option ST2C	Option ST2D	
Safety information associated with the existing affected road network	Healthy life expectancy (H) Mental wellbeing (H) Premature mortality (H)	Chapter 17 (Population - Accessibility). Disruption to the path network and traffic would be appropriately managed during construction and would not be expected to result in effects on safety or influence premature mortality of WCH or vehicle travellers.				A likely Neutral health and wellbeing outcome is anticipated for the communities for safety and the related NPF indicators during construction, for all proposed route options.

Table 20.10: Operation - Potential Effects on Health and Wellbeing Determinants and Likely Health Outcomes (Community Objective 1)

Community Objective 1: *Reduce current levels of noise and pollution in the villages of Dunkeld, Birnam and Inver to protect human health and wellbeing of residents and visitors and to enable them to peacefully enjoy their properties and amenity spaces.*						
DMRB LA 112 Health determinant	NPF Indicators	Residual Effects (post-mitigation) reported in DMRB Stage 2 Environmental Factor Assessments				Health and Wellbeing Determinants and Likely Health and Wellbeing Outcome
		Option ST2A	Option ST2B	Option ST2C	Option ST2D	
Air quality management areas and ambient air quality	Healthy life expectancy (H) Mental wellbeing (H) Premature mortality (H) Visits to the outdoors (E) Child wellbeing and happiness (Ch)	Chapter 15 (Air Quality) Generally, there is an increase in concentrations of pollutants at most receptors for all proposed route options. Although there are some differences between proposed route options in terms of number and types of effects, these effects are not considered significant as the pollutant concentrations at all assessed human health receptors are below the objective values set to protect human health.				There is no material difference between the proposed route options for this determinant, and pollutant concentrations during operation are anticipated to be below the objective values set to protect human health, as reported in Volume 1, Part 3 – Environmental Assessment (Chapter 15: Air Quality). None of the proposed route options are considered to influence premature mortality or life expectancy or discourage people from visiting the outdoors due to air pollution. Additionally, there would be no change to peoples' ability to peacefully enjoy their properties and amenity spaces. A likely Neutral health and wellbeing outcome is anticipated for the communities during operation from changes to air quality and relevant NPF indicators for all proposed route options.

Community Objective 1: ***Reduce current levels of noise and pollution in the villages of Dunkeld, Birnam and Inver to protect human health and wellbeing of residents and visitors and to enable them to peacefully enjoy their properties and amenity spaces.***						
DMRB LA 112 Health determinant	**NPF Indicators**	**Residual Effects (post-mitigation) reported in DMRB Stage 2 Environmental Factor Assessments**				**Health and Wellbeing Determinants and Likely Health and Wellbeing Outcome**
		Option ST2A	**Option ST2B**	**Option ST2C**	**Option ST2D**	
Areas recognised as being sensitive to noise and the ambient noise environment	Healthy life expectancy (H) Mental wellbeing (H) Premature mortality (H) Visits to the outdoors (E) Child wellbeing and happiness (Ch)	Chapter 16 (Noise and Vibration) During operation, all proposed route options would result in both increases and decreases in noise considered to be significant.				Overall, the differences in operational noise effects between the proposed route options are considered to be a differentiator, with Option ST2A having the lowest potential effect, Option ST2B an intermediate potential effect, and Option ST2C and Option ST2D the highest potential effects as reported in Volume 1, Part 3 – Environmental Assessment (Chapter 16: Noise and Vibration). Noise increases during operation would not pass the threshold at which there may be an influence on life expectancy or premature mortality for any of the proposed route options. However, as Option ST2C and Option ST2D are predicted to result in the least number of significant decreases in noise and the greatest number of significant increases in noise they may have the potential to cause disturbance and annoyance to the greatest number of properties, and adversely affect residents health and wellbeing and ability to peacefully enjoy their properties. As Option ST2A and Option ST2B are predicted to result in the greatest number of significant decreases in noise and the least number of significant increases in noise these proposed route options have the potential to cause disturbance and annoyance to the least number of properties and support residents health and wellbeing and ability to peacefully enjoy their properties. Overall, a likely Positive health and wellbeing outcome is anticipated for the communities during operation from changes to the noise environment and relevant NPF indicators for Option ST2A and Option ST2B. Overall, a likely Negative health and wellbeing outcome is anticipated for Option ST2C and Option ST2D.
		Options ST2A and ST2B predicted to result in the greatest number of significant decreases in noise and the least number of significant increases in noise. Option ST2A would have the lowest overall operational noise effect due to the presence of the cut and cover tunnel.	Options ST2A and ST2B predicted to result in the greatest number of significant decreases in noise and the least number of significant increases in noise. Option ST2B is expected to have intermediate effect on noise and vibration due to the lowered carriageway and underpass.	Options ST2C and ST2D are predicted to result in the least number of significant decreases in noise and the greatest number of significant increases in noise. Options ST2C and ST2D are considered to have the highest overall effect on noise and vibration during operation.	Options ST2C and ST2D are predicted to result in the least number of significant decreases in noise and the greatest number of significant increases in noise. Options ST2C and ST2D are considered to have the highest overall effect on noise and vibration during operation.	

Community Objective 1: ***Reduce current levels of noise and pollution in the villages of Dunkeld, Birnam and Inver to protect human health and wellbeing of residents and visitors and to enable them to peacefully enjoy their properties and amenity spaces.***						
DMRB LA 112 Health determinant	**NPF Indicators**	**Residual Effects (post-mitigation) reported in DMRB Stage 2 Environmental Factor Assessments**				**Health and Wellbeing Determinants and Likely Health and Wellbeing Outcome**
		Option ST2A	**Option ST2B**	**Option ST2C**	**Option ST2D**	
Sources of potential pollution	Healthy life expectancy (H) Premature mortality (H)	<u>Chapter 9 (Geology, Soils and Groundwater)</u> With regard to land contamination, it is anticipated that potential risks associated with development of brownfield sites can be managed during operation and therefore mitigated for all identified potential sources of land contamination. There are no differentiators in terms of effect significance post mitigation.				For all proposed route options, it is expected that potential effects on human health from contaminated land would be mitigated through appropriate risk assessments. There are no differentiators in terms of significance of effect post mitigation, as reported in Volume 1, Part 3 – Environmental Assessment (Chapter 9: Geology, Soils and Groundwater). None of the proposed route options are considered to influence premature mortality or life expectancy through exposure to pollution from contaminated land. A likely Neutral health and wellbeing outcome is anticipated for the communities during operation from potential pollution from contaminated land and the related NPF indicators for all proposed route options.
Green/Open Space and severance/ separation of communities from such facilities	Child wellbeing and happiness (Ch) Access to green and blue space (C) Mental wellbeing (H) Visits to the outdoors (E)	<u>Chapter 8 (Population - Land Use)</u> Land-take and changes to accessibility for certain community land interests as a result of the proposed route options is considered to have the potential for significant effects.				The differences in land-take from community land during operation are considered sufficient to be a differentiator between proposed route options, as reported in Volume 1, Part 3 – Environmental Assessment (Chapter 8: Population - Land Use). Option ST2A provides potential for creation of additional green space while Option ST2C has the greatest land-take from community land designated as Open Space. A reduction in the availability of community land could reduce visits to the outdoors and affect access to green and blue space, resulting in potentially adverse effects on social cohesion and connectivity. Additionally, there could be fewer opportunities for the communities to peacefully enjoy outdoor amenity spaces if less Open Space is available. It should be noted that where land-take is required, resulting in the loss of all or part of land used by the community designated as
		Approx. 0.2ha land-take of which 0.1ha designated Open Space. Potential for creation of a new recreational area (informal Open Space) for use by the local community. Net gain of 3.8ha in community land. Change in accessibility to community land via	Approx. 0.2ha land-take of which 0.1ha designated Open Space. Change in accessibility to community land via Core Path DUNK/63 (Path 41).	Approx. 0.7ha land-take of which 0.3ha designated Open Space. Change in accessibility to community land via Core Path DUNK/63 (Path 41).	Approx. 0.2ha land-take of which 0.1ha designated Open Space. Change in accessibility to community land via Core Path DUNK/63 (Path 41).	

Community Objective 1: ***Reduce current levels of noise and pollution in the villages of Dunkeld, Birnam and Inver to protect human health and wellbeing of residents and visitors and to enable them to peacefully enjoy their properties and amenity spaces.***						
DMRB LA 112 Health determinant	**NPF Indicators**	**Residual Effects (post-mitigation) reported in DMRB Stage 2 Environmental Factor Assessments**				**Health and Wellbeing Determinants and Likely Health and Wellbeing Outcome**
		Option ST2A	**Option ST2B**	**Option ST2C**	**Option ST2D**	
		Core Path DUNK/63 (Path 41).				green/open space, the DMRB Stage 3 design would be developed to reduce land-take. Consideration would also be given to the provision of exchange land. Where the proposed scheme has the potential to create a new area of community land the DMRB Stage 3 design would be developed to enhance this area for the community and support its designation as informal or formal Open Space. A likely Positive health and wellbeing outcome is anticipated for the communities during operation for access to green/open space and the related NPF indicators for Option ST2A. A likely Neutral health and wellbeing outcome is anticipated for Option ST2B, Option ST2C and Option ST2D.

Table 20.11: Operation - Potential Effects on Health and Wellbeing Determinants and Likely Health Outcomes (Community Objective 3)

Community Objective 3: Provide better, safer access on and off the A9 from both sides of the road while ensuring easy, safe movement of vehicular traffic and Walkers, Cyclists and Horse-riders (WCH) through the villages, helping to reduce stress and anxiety and support the local community.						
DMRB LA 112 Health determinant	**NPF Indicators**	**Residual Effects (post-mitigation) reported in DMRB Stage 2 Environmental Factor Assessments**				**Health and Wellbeing Determinants and Likely Health and Wellbeing Outcome**
		Option ST2A	**Option ST2B**	**Option ST2C**	**Option ST2D**	
Safety information associated with the existing affected road network	Healthy life expectancy (H) Premature mortality (H) Mental wellbeing (H)	<u>Volume 1 – Part 4 – Traffic and Economic Assessment</u> One of the key objectives of the A9 Dualling Programme is to improve safety for motorised and non-motorised users by reducing accident severity and reducing driver stress. All proposed route options would result in quicker journey times when compared to the Do-Minimum scenario. Option ST2C would have the greatest journey time savings, followed by Options ST2A and ST2D. Option ST2A would have the least journey time savings of all proposed route options. Across all proposed route options, the average number of accidents forecast per year would be expected to reduce compared to the Do-Minimum scenario. All proposed route options are expected to result in a				All proposed route options aim to provide beneficial effects during operation for the community, road users and WCH, by improving road safety through provision of junction improvements and WCH crossing points in line with current safety standards. The improvements are predicted to reduce journey times for vehicle travellers, and as a result potentially relieve driver stress and frustration, which has the potential to result in dangerous overtaking manoeuvres and subsequently road accidents.

Community Objective 3: Provide better, safer access on and off the A9 from both sides of the road while ensuring easy, safe movement of vehicular traffic and Walkers, Cyclists and Horse-riders (WCH) through the villages, helping to reduce stress and anxiety and support the local community.						
DMRB LA 112 Health determinant	**NPF Indicators**	**Residual Effects (post-mitigation) reported in DMRB Stage 2 Environmental Factor Assessments**				**Health and Wellbeing Determinants and Likely Health and Wellbeing Outcome**
		Option ST2A	**Option ST2B**	**Option ST2C**	**Option ST2D**	
	Child wellbeing and happiness (Ch)	reduction in the number of personal injury accidents. Relatively low savings in slight accidents are forecast, however higher saving in serious and fatal accidents is forecast, particularly for Option ST2C, which provides full grade separated junctions throughout. Only Option ST2C would provide a fully compliant Category 7A dual carriageway with grade separated junctions at Birnam, Dunkeld and Dalguise to access/egress the A9 and connect to the existing road network. This would provide a safety benefit over the existing layout, which incorporates at-grade junctions and right-turn manoeuvres across the carriageway. Potential accidents at the entry to or on the circulatory carriageway for Options ST2A, ST2B and ST2C could limit the number of operational traffic lanes and cause northbound traffic to queue on the approach. For Option ST2A this would result in traffic queueing within the cut and cover tunnel, introducing a potential safety issue. It is noted that the emergency services have noted the potential hazard and the impact that may have on response times. If Option ST2A was progressed, measures to prevent queuing within the cut and cover tunnel would be required. Chapter 17 (Population - Accessibility) During operation, for all proposed route options, WCH would no longer be permitted to cross the A9 at-grade for all proposed route options, enhancing their safety and that of vehicle travellers. Bus services would be maintained during operation and expected to improve due to the dual carriageway increasing journey reliability through a reduction of road closures from collisions, in line with the A9 dualling objectives.				All proposed route options would provide better, safer access on and off the A9 and this may potentially contribute to improved mental wellbeing and healthy life expectancy, through the potential alleviation of driver stress and premature mortality caused by road accidents. A likely Positive health and wellbeing outcome is anticipated for the communities during operation from changes to safety and the related NPF indicators for all proposed route options, but particularly for Option ST2C.
Transport network and usage in the area	Journeys by active travel (H) Physical activity (H) Visits to the outdoors (E) Access to green and blue space (C)	Chapter 17 (Population - Accessibility) Significant adverse effects on amenity value and/or journey length for 12 routes. Significant beneficial effect on amenity value and/or journey length	Chapter 17 (Population - Accessibility) Significant adverse effects on amenity value and/or journey length for 13 routes. Significant beneficial effect on amenity value	Chapter 17 (Population - Accessibility) Significant adverse effects on amenity value and/or journey length for 12 routes. Significant beneficial effect on amenity value	Chapter 17 (Population - Accessibility) Significant adverse effects on amenity value and/or journey length for 12 routes. Significant beneficial effect on amenity value	The differences in effects during operation between proposed route options are not sufficient to be considered a differentiator for journey length or amenity value, as reported in Volume 1, Part 3 – Environmental Assessment (Chapter 17: Population - Accessibility). Improvements to path amenity could enhance the easy, safe movement of WCH through the villages and reduce stress and anxiety in the communities. The diversion of Path 22/NCR77, which would be severed by Option ST2A, would be re-routed on top of the cut and cover tunnel, and it is anticipated that there

Community Objective 3: Provide better, safer access on and off the A9 from both sides of the road while ensuring easy, safe movement of vehicular traffic and Walkers, Cyclists and Horse-riders (WCH) through the villages, helping to reduce stress and anxiety and support the local community.						
DMRB LA 112 Health determinant	**NPF Indicators**	**Residual Effects (post-mitigation) reported in DMRB Stage 2 Environmental Factor Assessments**				**Health and Wellbeing Determinants and Likely Health and Wellbeing Outcome**
		Option ST2A	**Option ST2B**	**Option ST2C**	**Option ST2D**	
	Child wellbeing and happiness (Ch)	for two routes, including Path 22/NCR77.	and/or journey length for one route.	and/or journey length for one route.	and/or journey length for one route.	would be an increase in amenity value along this section as WCH would no longer be travelling adjacent to vehicular traffic. A likely Positive health and wellbeing outcome is anticipated for the communities during operation from changes to the transport network and usage and related NPF indicators for Option ST2A. A likely Neutral health and wellbeing outcome is anticipated for the communities during operation for Option ST2B, Option ST2C and Option ST2D.
Community, recreational and education facilities and severance/ separation of communities from such facilities	Places to interact (C) Healthy life expectancy (H) Physical activity (H) Mental wellbeing (H) Child wellbeing and happiness (Ch)	Chapter 8 (Population - Land Use) Replacement of car parking at Dunkeld & Birnam Station and direct connection to Station Road for vehicles and WCH. Access to southbound platform would be Equality Act 2010 compliant. Change in accessibility to community assets via Core Path DUNK/11 (Path 28).	Chapter 8 (Population - Land Use) Replacement of car parking at Dunkeld & Birnam Station and direct connection to Station Road for vehicles and WCH. Access to southbound platform would be Equality Act 2010 compliant. Change in accessibility to community assets via Core Path DUNK/11 (Path 28).	Chapter 8 (Population - Land Use) Replacement of car parking at Dunkeld & Birnam Station on site of Birnam Industrial Estate. Access to southbound platform would be Equality Act 2010 compliant.	Chapter 8 (Population - Land Use) Replacement of car parking at Dunkeld & Birnam Station on site of Birnam Industrial Estate. Access to southbound platform would be Equality Act 2010 compliant.	The differences in impacts and effects on community assets are not considered sufficient to be a differentiator between the proposed route options, as reported in Volume 1, Part 3 – Environmental Assessment (Chapter 8: Population - Land Use). Improvements to accessibility and replacement car parking at Dunkeld & Birnam Station would assist in ensuring easy, safe movement of vehicles and WCHs through the villages and may help to reduce stress and anxiety. Improved access to places to interact could provide benefits in relation to social cohesion and mental health. A likely Positive health and wellbeing outcome is anticipated for the communities during operation in relation to severance/separation from community, recreational and education facilities and the related NPF indicators for all proposed route options.
Healthcare facilities and severance/ separation of	Healthy life expectancy (H) Premature mortality (H)	Chapter 8 (Population - Land Use) No change in severance/separation of communities from healthcare facilities has been reported in Volume 1, Part 3 – Environmental Assessment (Chapter 8: Population - Land Use) during operation.				As there is no change to severance/separation from healthcare facilities during operation, a likely Neutral human health outcome is anticipated for the communities for all proposed route options.

Community Objective 3: Provide better, safer access on and off the A9 from both sides of the road while ensuring easy, safe movement of vehicular traffic and Walkers, Cyclists and Horse-riders (WCH) through the villages, helping to reduce stress and anxiety and support the local community.						
DMRB LA 112 Health determinant	**NPF Indicators**	**Residual Effects (post-mitigation) reported in DMRB Stage 2 Environmental Factor Assessments**				**Health and Wellbeing Determinants and Likely Health and Wellbeing Outcome**
		Option ST2A	**Option ST2B**	**Option ST2C**	**Option ST2D**	
communities from such facilities	Mental wellbeing (H) Child wellbeing and happiness (Ch)					

Table 20.12: Operation - Potential Effects on Health and Wellbeing Determinants and Likely Health Outcomes (Community Objective 5)

Community Objective 5: Examine and identify opportunities to enhance the levels of cycling and walking for transport and leisure, including the improvement of existing footpaths and cycle ways, to promote positive mental health and wellbeing.						
DMRB LA 112 Health determinant	**NPF Indicators**	**Residual Effects (post-mitigation) reported in DMRB Stage 2 Environmental Factor Assessments**				**Health and Wellbeing Determinants and Likely Health and Wellbeing Outcome**
		Option ST2A	**Option ST2B**	**Option ST2C**	**Option ST2D**	
Safety information associated with the existing affected road network	Healthy life expectancy (H) Mental wellbeing (H) Physical activity (H) Premature mortality (H)	Chapter 17 (Population - Accessibility) Potential effects on WCHs include changes in journey length (increase/decrease) or a change in amenity value (increase/decrease). During operation, all proposed route options would be considered to benefit WCH in the following ways: ▪ WCH would no longer be permitted to cross the A9 at-grade for all proposed route options, enhancing their safety and that of vehicle travellers; ▪ the continuity of the national cycle route would be maintained in the vicinity of the proposed route options; and ▪ bus services would be maintained during operation and expected to improve due to the dual carriageway increasing journey reliability through a reduction of road closures from collisions, in line with the A9 dualling objectives.				All proposed route options aim to provide beneficial effects during operation for the community, road users and WCH, by improving road safety through provision of junction improvements and WCH crossing points in line with current safety standards. This could potentially contribute to improved mental wellbeing and healthy life expectancy, through the reduction in driver stress and premature mortality caused by road accidents. Improvements to the safety of WCH routes may enhance the levels of cycling and walking within the communities during operation, improving mental wellbeing and influencing life expectancy. A likely Positive health and wellbeing outcome is anticipated for the communities during operation from improvements to safety for WCH for all proposed route options.

Community Objective 5: Examine and identify opportunities to enhance the levels of cycling and walking for transport and leisure, including the improvement of existing footpaths and cycle ways, to promote positive mental health and wellbeing.						
DMRB LA 112 Health determinant	**NPF Indicators**	**Residual Effects (post-mitigation) reported in DMRB Stage 2 Environmental Factor Assessments**				**Health and Wellbeing Determinants and Likely Health and Wellbeing Outcome**
		Option ST2A	**Option ST2B**	**Option ST2C**	**Option ST2D**	
Transport network and usage in the area	Journeys by active travel (H) Physical activity (H) Visits to the outdoors (E) Access to green and blue space (C)	Chapter 17 (Population - Accessibility) Significant adverse effects on amenity value and/or journey length for 12 routes. Significant beneficial effect on amenity value and/or journey length for two routes, including Path 22/NCR77.	Chapter 17 (Population - Accessibility) Significant adverse effects on amenity value and/or journey length for 13 routes. Significant beneficial effect on amenity value and/or journey length for one route.	Chapter 17 (Population - Accessibility) Significant adverse effects on amenity value and/or journey length for 12 routes. Significant beneficial effect on amenity value and/or journey length for one route.	Chapter 17 (Population - Accessibility) Significant adverse effects on amenity value and/or journey length for 12 routes. Significant beneficial effect on amenity value and/or journey length for one route.	The differences in impacts during operation between proposed route options are not sufficient to be considered a differentiator for journey length or amenity value, as reported in Volume 1, Part 3 – Environmental Assessment (Chapter 17: Population - Accessibility). Improvements to existing footpaths and cycle ways, including changes to journey length and enhanced path amenity, may promote positive mental health and wellbeing within the community during operation. There is potential for the changes to WCH routes to affect journeys by active travel, access to green and blue space, and visits to the outdoors during operation. The diversion of Path22/NCR77, which would be severed by Option ST2A, would be re-routed on top of the cut and cover tunnel, and it is anticipated that there would be an increase in amenity value along this section as WCH would no longer be travelling adjacent to vehicular traffic. This could in turn potentially lead to an increase in journeys by active travel and enhance the levels of cycling and walking for transport and leisure during operation. A likely Positive health and wellbeing outcome is anticipated for the communities during operation from changes to the transport network and usage and related NPF indicators for Option ST2A. A likely Neutral health and wellbeing outcome is anticipated for the communities during operation for all other proposed route options.
Landscape amenity	Mental wellbeing (H) Physical activity (H)	Chapter 12 (Landscape) Slight adverse significant effects reported for Strath Tay: Dunkeld and Birnam Local Landscape	Chapter 12 (Landscape) Slight adverse significant effects reported for Strath Tay: Dunkeld and Birnam LLCA	Chapter 12 (Landscape) Moderate adverse effect reported for Strath Tay:	Chapter 12 (Landscape) Slight adverse significant effects reported for Strath Tay: Dunkeld and	The differences between proposed route options during operation are considered sufficient to be differentiators, with Option ST2A and Option ST2D having the lowest overall effect and Option ST2B and Option ST2C the highest overall effect when considering potential effects on both landscape character and landscape

Community Objective 5: Examine and identify opportunities to enhance the levels of cycling and walking for transport and leisure, including the improvement of existing footpaths and cycle ways, to promote positive mental health and wellbeing.						
DMRB LA 112 Health determinant	**NPF Indicators**	**Residual Effects (post-mitigation) reported in DMRB Stage 2 Environmental Factor Assessments**				**Health and Wellbeing Determinants and Likely Health and Wellbeing Outcome**
		Option ST2A	**Option ST2B**	**Option ST2C**	**Option ST2D**	
	Journeys by active travel (H) Visits to the outdoors (E)	Character Area (LLCA) (Settlement), Strath Tay: Mid Glen LLCA, Murthly Castle GDL, The Hermitage GDL, and a Slight beneficial effect on Birnam Conservation Area. Chapter 13 (Visual) Significant adverse visual effects are predicted for all route options with Option ST2A and ST2D having the lowest overall effect. Option ST2A has potential for landscaping the covered tunnel with amenity space in addition to improvements to the footpath and cycle networks.	(Settlement), Strath Tay: Mid Glen LLCA, Murthly Castle GDL, The Hermitage GDL, and Birnam Conservation Area. Chapter 13 (Visual) Significant adverse visual effects are predicted for all route options with Option ST2B having an intermediate overall effect.	Dunkeld and Birnam LLCA. Slight adverse significant effects reported for Strath Tay: Mid Glen LLCA, Murthly Castle GDL, The Hermitage GDL, and Birnam Conservation Area. Chapter 13 (Visual) Significant adverse visual effects are predicted for all route options with Option ST2B having the highest overall effect.	Birnam LLCA (Settlement), Strath Tay: Mid Glen LLCA, Murthly Castle GDL, The Hermitage GDL, and Birnam Conservation Area. Chapter 13 (Visual) Significant adverse visual effects are predicted for all route options with Option ST2A and ST2D having the lowest overall effect.	designations, as reported in Volume 1, Part 3 – Environmental Assessment (Chapter 12: Landscape). The differences in effects on visual amenity associated with the proposed route options assessed that Option ST2A would have the greatest potential benefits as a result of the cut and cover tunnel in combination with landscape mitigation, as reported in Volume 1, Part 3 – Environmental Assessment (Chapter 13: Visual). All proposed route options have potential to have adverse landscape and visual effects during operation and as a result may reduce visits to the outdoors, journeys by active travel, and physical activity. However, any adverse landscape amenity effects which may affect health and wellbeing would be expected to reduce over time with the establishment of landscape mitigation planting. Option ST2C offers lesser opportunities for mitigation planting, reducing the likelihood of landscape amenity improving over time. The potential for landscaping the cut and cover tunnel with amenity space in addition to improvements to the footpath and cycle networks as part of Option ST2A may enhance the overall amenity of walking and cycling in the area. This may potentially contribute to an increase in physical activity, journeys by active travel and visits to the outdoors, which this may have a potentially beneficial effect on mental wellbeing and physical health. A likely Positive health and wellbeing outcome is anticipated for the communities during operation from changes to landscape amenity for Option ST2A, and a likely Negative health and wellbeing outcome is anticipated for Option ST2C. A likely Neutral health and wellbeing outcome is anticipated for the communities from changes to landscape amenity for Options ST2B and Option ST2D.

Table 20.13: Operation - Potential Effects on Health and Wellbeing Determinants and Likely Health Outcomes (Community Objective 7)

Community Objective 7: ***Preserve and enhance the integrity of the unique and rich historical and cultural features of the Dunkeld, Birnam and Inver communities, thereby supporting wellbeing and the local economy.***						
DMRB LA 112 Health determinant	**NPF Indicators**	**Residual Effects (post-mitigation) reported in DMRB Stage 2 Environmental Factor Assessments**				**Health and Wellbeing Determinants and Likely Health and Wellbeing Outcome**
		Option ST2A	**Option ST2B**	**Option ST2C**	**Option ST2D**	
Community, recreational and education facilities and severance/ separation of communities from such facilities; *(cultural heritage assets)*	Attendance at cultural events or places of culture (Cu) Participation in a cultural activity (Cu) Places to interact (C) State of historic sites (E) Visits to the outdoors (E) Child wellbeing and happiness (Ch)	Chapter 14 (Cultural Heritage) A number of potential options to maintain access to Dunkeld & Birnam Station have been assessed as part of the DMRB Stage 2 assessment, referred to as 'access options' and described in detail in Section 14.4 of Volume 1, Part 3 – Environmental Assessment (Chapter 14: Cultural Heritage). There is potential for significant adverse effects on cultural heritage assets for all proposed route options, though significance varies depending on the potential access option. Option ST2A and Option ST2B with access option 1 or access option 3 would have the potential for a more significant effect on Dunkeld & Birnam Station including Footbridge than Option ST2A and Option ST2B with access option 2, access option 4 or access option 5. Option ST2A and Option ST2B with access option 2, access option 4 or access option 5 are also predicted to have lower effect on Dunkeld & Birnam Station including Footbridge than Option ST2C and Option ST2D. However, for Options ST2A and ST2B with all access options there would be a larger beneficial effect on Dunkeld & Birnam Station including Footbridge than for Options ST2C and ST2D a Slight beneficial effect has been assessed. Option ST2A or Option ST2B with access option 1 or access option 3 have been assessed to have a greater effect during operation on Birnam Conservation Area. For all proposed route options permanent land-take would reinforce the existing severance and effect on the setting of Murthly Castle designed landscape.				All proposed route options would result in some beneficial and some adverse effects, with varying levels of significance, on Dunkeld & Birnam Station during operation. The difference in effects to cultural heritage assets are considered to be differentiators between the proposed route options, as reported in Volume 1, Part 3 – Environmental Assessment (Chapter 14: Cultural Heritage). The re-establishment of the physical connection between Dunkeld & Birnam Station and Birnam via Station Road would potentially improve the state of the historic building and provide a new amenity space for the community to enjoy, connecting the community to a local cultural heritage feature. This would potentially increase attendance at places of culture, places to interact, and participation in a cultural activity, thereby having the potential for a beneficial effect on wellbeing. These potentially beneficial effects would be greatest for Option ST2A and Option ST2B. For Option ST2C and Option ST2D, a pedestrian underpass would connect the village to the Dunkeld & Birnam Station and would improve accessibility from the existing situation. However, all options connect Birnam to Dunkeld & Birnam Station and therefore it is considered that all proposed route options would have a similar effect on health and wellbeing as a result of the improved access. Murthly Castle GDL and the Birnam Conservation Area would be adversely affected by all proposed route options, which may potentially reduce participation/attendance at these sites and

Community Objective 7: ***Preserve and enhance the integrity of the unique and rich historical and cultural features of the Dunkeld, Birnam and Inver communities, thereby supporting wellbeing and the local economy.***						
DMRB LA 112 Health determinant	**NPF Indicators**	**Residual Effects (post-mitigation) reported in DMRB Stage 2 Environmental Factor Assessments**				**Health and Wellbeing Determinants and Likely Health and Wellbeing Outcome**
		Option ST2A	**Option ST2B**	**Option ST2C**	**Option ST2D**	
						impact on social cohesion and connectivity. It is uncertain the extent to which such effects would occur at this stage and the implications for the health and wellbeing of the communities. A likely Neutral health and wellbeing outcome is anticipated for the communities during operation from changes to severance/separation from community, recreational, and education facilities and related NPF indicators for all proposed route options.

20.5 Potential Mitigation

20.5.1 For the DMRB Stage 2 assessment, the design has not been sufficiently developed to allow the mitigation measures to be defined in detail at this stage. The objective of this section is to identify potential mitigation measures which would be further developed and refined during the DMRB Stage 3 assessment.

20.5.2 The design of the proposed scheme shall be developed with cognisance of effects on the communities of Dunkeld, Little Dunkeld, Birnam and Inver and the alignment shall be routed, where possible, to avoid the most significant effects on people. An iterative approach to the route optioneering has been adopted throughout DMRB Stage 2 (as explained in Volume 1, Part 3 – Environmental Assessment, Chapter 7: Overview of Environmental Assessment), and shall be continued throughout further design of the Preferred Route Option at DMRB Stage 3.

20.5.3 During the DMRB Stage 3 Environmental Impact Assessment (EIA), it is likely that the majority of potentially significant effects on human health and wellbeing would be reduced by the essential mitigation measures proposed in the relevant environmental chapters referred to in this assessment. For example, effects on air quality which could result in health and wellbeing effects would be mitigated by measures set out in the Air Quality assessment, and effects on core paths and cycle routes which could result in health and wellbeing effects would be mitigated by measures set out in the Population – Accessibility assessment.

20.5.4 The DMRB Stage 3 EIA human health assessment may propose additional mitigation measures where a residual effect (post-mitigation) is reported in the relevant assessment of an environmental factor and a resulting significant human health and wellbeing effect is assessed. Examples of potential mitigation measures for health and wellbeing include providing potential offset/enhancement measures such as investment in community initiatives such as tree planting on community land/open space as a means of enhancing the local landscape amenity., and monitoring of effects by undertaking a community survey.

20.6 Summary of Route Options Assessment

20.6.1 Taking into account the results of the assessment tables in Section 20.4 (Potential Impacts and Effects), this section provides a summary of potential effects on health and wellbeing, referring to relevant health and wellbeing determinants where appropriate, as well as a commentary where there is potential for differentiators between health and wellbeing outcomes between the route options.

20.6.2 For the comparison of proposed route options, two aspects are considered; whether the potential for residual effects would be considered significant in the context of the EIA Regulations; and whether any of the potential impacts and effects identified differ sufficiently between proposed route options such that they can be considered a differentiator and need to be considered as part of the overall identification of the Preferred Route Option which takes into account environmental considerations as well as engineering, economic and traffic considerations.

Construction

20.6.3 Several environmental factors have the potential to effect health and wellbeing determinants across all proposed route options during the construction phase. Noise and vibration associated with construction activities has the potential to cause disturbance and annoyance to residents, affecting health and wellbeing. Severance/separation from community facilities and green/open space is anticipated due to disruption and changes in access, and this would particularly affect health and wellbeing of vulnerable groups, such as young people including school children, the elderly and people with disabilities, as these groups have a propensity to visit these facilities and places to interact more than others. Additionally, for Option ST2C, access to Craigvinean Health Centre and Dunkeld and Birnam Recreation Club would

be affected, which may dissuade people in the communities from accessing health care or from undertaking physical activity.

20.6.4 Furthermore, the effect on the transport network and usage is anticipated to be significant for WCH across all proposed route options during construction, caused by an increase in disruption and reduction in amenity value, and an increase in driver stress for vehicle travellers is anticipated, which may in turn affect health and wellbeing. Though appropriate diversions will be in place, the communities would experience a degree of severance/separation from cultural heritage assets as a result of construction activities – specifically Dunkeld & Birnam Station, Birnam Conservation Area and Murthly GDL - leading to a potential reduction in attendance and participation, affecting social cohesion and community connectivity.

20.6.5 It is expected that the changes to health and wellbeing determinants and their resulting effects on the communities would be similar, due to the disruptive activities required during construction. Therefore, duration of construction period and nature of construction activities are key factors in identifying the proposed route option with the least likely adverse effect on the health and wellbeing of the communities. It is surmised that Option ST2A is most likely to result in an increase in stress and anxiety of members of the communities from changes to the noise environment, due to the nature and duration of the required construction activities, which would include extensive piling and excavation. In addition, the communities would experience severance/separation from community, recreational and education facilities and open space for the longest period due to construction activities, at a duration of 4.5 - 5 years for Option ST2A. Conversely, as Option ST2D has the least intrusive construction activities and the shortest construction period of 2.5 - 3 years, it is therefore considered to be the proposed route option that would have the least likely effect on the health and wellbeing of the communities at this stage.

20.6.6 In accordance with Table 20.4, it is identified that there is the potential for a range of health and wellbeing outcomes (Positive, Neutral and Negative) to arise during construction and resulting from changes in health and wellbeing determinants. Using professional judgement and balancing the range of potential effects on determinants, an overall Negative health and wellbeing outcome is identified during construction across all proposed route options. This Negative health and wellbeing outcome would be considered significant, though temporary and likely to be reversible following completion of construction. The longer duration of adverse effects associated with Option ST2A across various health and wellbeing determinants as well as the effects on healthcare and recreational facilities for Option ST2C are considered differentiators for health and wellbeing outcomes.

Operation

20.6.7 This section sets out the likely health and wellbeing outcomes for the communities reported in Tables 20.10 – 20.13 and identifies where changes to health and wellbeing determinants actively contribute to the community objectives.

Community Objective 1

20.6.8 A likely Neutral health and wellbeing outcome is anticipated for the communities from changes to air quality and related NPF indicators for all proposed route options.

20.6.9 A likely Positive health and wellbeing outcome is anticipated for the communities in relation to changes in the noise environment and related NPF indicators and for Option ST2A and Option ST2B. A likely Negative health and wellbeing outcome is anticipated for the communities in relation to changes in the noise environment and related NPF indicators for Options ST2C and Option ST2D.

20.6.10 A likely Neutral health and wellbeing outcome is anticipated for the communities from potential pollution from contaminated land and related NPF indicators for all proposed route options.

20.6.11 A likely Positive health and wellbeing outcome is anticipated for the communities from changes in access to green/open space and related NPF indicators for Option ST2A. A likely Neutral health and wellbeing outcome is anticipated for all other proposed route options.

20.6.12 The differences in operational noise effects between the proposed route options has been identified as a differentiator in Volume 1, Part 3 – Environmental Assessment (Chapter 16: Noise and Vibration), with the most beneficial effects predicted from Option ST2A, and the fewest beneficial effects from Option ST2C and Option ST2D. Increased noise and vibration levels across a number of properties for Option ST2C and Option ST2D have the potential to cause disturbance and annoyance to residents, and adversely affect their health and wellbeing and ability to peacefully enjoy their properties. In terms of reducing current levels of noise, Option ST2A and Option ST2B actively contribute towards this community objective.

20.6.13 Option ST2A has the potential for creation of additional green space within the community, providing more opportunity for the peaceful enjoyment of amenity spaces, while Option ST2C has the greatest effect on land-take. A reduction in the availability of green/open space could have a potentially adverse effect on social cohesion and connectivity and provide fewer opportunities for the communities to peacefully enjoy their outdoor amenity spaces. Taking into account the core elements of this community objective, Option ST2A is therefore predicted to contribute most to this community objective, and Option ST2C to contribute least.

Community Objective 3

20.6.14 A likely Positive health and wellbeing outcome is anticipated for the communities from changes to safety for WCH and vehicle travellers and related NPF indicators for all proposed route options, but particularly for Option ST2C.

20.6.15 A likely Positive Neutral health and wellbeing outcome is anticipated for the communities from changes to the transport network and usage and related NPF indicators for Option ST2A. A likely Neutral health and wellbeing outcome is anticipated for the communities for Option ST2B, Option ST2C and Option ST2D.

20.6.16 A likely Positive health and wellbeing outcome is anticipated for the communities in relation to severance/separation from community, recreational and education facilities and related NPF indicators for all proposed route options.

20.6.17 A likely Neutral human health outcome is anticipated for the communities in relation to severance/separation from healthcare facilities and related NPF indicators for all proposed route options.

20.6.18 It is predicted that there would be a beneficial effect on road safety through provision of grade separated junctions and WCH crossing points that would be designed to current safety standards for all proposed route options. The improvements are predicted to reduce journey times for vehicle travellers, and as a result relieve driver stress and frustration and potentially reduce accidents.

20.6.19 Improvements to path amenity and replacement of car parking at Dunkeld & Birnam Station would assist in ensuring the easy, safe movement of WCH and vehicle travellers through the villages and reduce stress and anxiety in the communities. Effects on the safe movement of vehicular traffic and WCH are expected to be broadly similar for all proposed route options during the operational phase.

20.6.20 There is potential for an increase in amenity value for WCH using Path 22/NCR77 for Option ST2A, where this path could be diverted on top of the cut-and-cover tunnel. Due to the potential additional benefit for WCH in Option ST2A during operation, it has been determined that Option ST2A contributes most to

this objective. Option ST2B, Option ST2C and Option ST2D align with the core elements of this objective but to a lesser extent.

Community Objective 5

20.6.21 A likely Positive health and wellbeing outcome is anticipated for the communities from improvements to safety for WCH for all proposed route options.

20.6.22 A likely Positive health and wellbeing outcome is anticipated for the communities from changes to the transport network and usage and related NPF indicators for Option ST2A. A likely Neutral health and wellbeing outcome is anticipated for the communities for Option ST2B, Option ST2C and Option ST2D.

20.6.23 A likely Positive health and wellbeing outcome is anticipated for the communities from changes to landscape amenity and related NPF indicators for Option ST2A, and a likely Negative health and wellbeing outcome is anticipated for Option ST2C. A likely Neutral health and wellbeing outcome is anticipated for the communities from changes to landscape amenity for Options ST2B and ST2D.

20.6.24 All proposed route options are predicted to have effects on WCH routes, including changes in journey length (increase/decrease) or a change in amenity value (increase/decrease). This is not considered a differentiator between options in Volume 1, Part 3 – Environmental Assessment (Chapter 17: Population - Accessibility), as the effects would be broadly similar.

20.6.25 Option ST2A has the potential for improvements to Path 22/NCR77 as part out the route, where the WCH route would be placed on top of the cut and cover tunnel and landscape planting would be included, providing additional amenity space as a result. It is anticipated that there would be an increase in amenity value along this section from the landscape planting and as WCH would no longer be travelling adjacent to vehicular traffic. This could potentially lead to an increase in journeys by active travel and enhance the levels of cycling and walking for transport and leisure. amenity, promoting positive mental wellbeing and physical health within the community.

20.6.26 Conversely, Option ST2C would provide less opportunity for landscape mitigation planting. As a result of the potential opportunities for improved amenity of WCH routes, it is considered that Option ST2A contributes most to this community objective and Option ST2C contributes the least.

Community Objective 7

20.6.27 A likely Neutral health and wellbeing outcome is anticipated for the communities from changes to severance/separation from community, recreational, and education facilities (cultural heritage assets) and related NPF indicators, for all proposed route options.

20.6.28 The difference in effects to cultural heritage assets were identified as differentiators in Volume 1, Part 3 – Environmental Assessment (Chapter 14: Cultural Heritage). For Option ST2A and Option ST2B with all access options there would be a larger beneficial effect on Dunkeld & Birnam Station including Footbridge than for Option ST2C and Option ST2D. It is also recognised that the construction effects of Option ST2A and Option ST2B and some of the access options proposed would somewhat reduce these beneficial effects. All options connect the village to Dunkeld & Birnam Station and therefore it is considered that all proposed route options would have a similar level of contribution towards this community objective.

20.6.29 The benefits of re-establishment of the connection between Dunkeld & Birnam Station and Birnam via Station Road, and potential for re-use of the station building would actively contribute to the community objective, helping to preserve and enhance the integrity of the unique and rich historical and cultural features of the communities. This would potentially increase attendance at places of culture, places to interact, and participation in a cultural activity, thereby having the potential for a beneficial effect on

wellbeing. However, Murthly Castle GDL and the Birnam Conservation Area would be adversely affected by all proposed route options, which may reduce the potential wellbeing benefits in relation to enhancement of cultural heritage features.

20.6.30 It is considered that all four proposed options would contribute somewhat to this community objective.

Summary of Assessment

20.6.31 There are likely Positive, Neutral and Negative outcomes for communities from changes to health and wellbeing determinants associated with each of the proposed route options, including those identified as differentiators in the Section 20.4 (Tables 20.9 – 20.13) and summarised in Section 20.6.

20.6.32 Using professional judgement and balancing the likely health and wellbeing outcomes across the various health and wellbeing determinants, during construction an overall likely Negative health and wellbeing outcome is identified during construction across all proposed route options, which is considered significant.

20.6.33 During operation, some of the proposed route options would contribute more towards the community objectives than others, and it is considered that those proposed route options which contribute towards the objectives would have a likely Positive health and wellbeing outcome for the communities. Therefore, an overall likely Positive health and wellbeing outcome has been identified for Option ST2A, which is considered significant. An overall likely Neutral health and wellbeing outcome has been identified for Option ST2B, Option ST2C and Option ST2D, which is considered not significant.

Compliance Against Plans and Policies.

20.6.34 DMRB LA 104 (Highways England *et al,* 2020b) states that environmental assessment, reporting and monitoring shall meet the requirements of the national planning policy for each relevant Overseeing Organisation.

20.6.35 *Appendix A21.1 (Assessment of Policy Compliance)* provides a review of national, regional and local policy documents which are of relevance to this assessment undertaken and reported in this chapter in accordance with DMRB guidance.

20.6.36 National Planning Policy objectives (and accompanying best practice guidance) of relevance to this assessment are provided in National Planning Framework 3 (NPF3) (Scottish Government, 2014a), Scottish Planning Policy (SPP) (Scottish Government 2014b; Revised 2020) themes *Sustainability, Valuing the Natural Environment* and *Managing Flood Risk and Drainage*, as well as the National Transport Strategy 2 (NTS2) (Transport Scotland, 2020), the Climate Change Plan (Scottish Government, 2018) and the Environment Strategy for Scotland (Scottish Government, 2020b). In addition, local policies of relevance include Perth and Kinross Local Development Plan 2 (PKC LDP2) (PKC, 2019) Policies 56 (Noise Pollution) and 57 (Air Quality), as well as TAYplan Policy 2 (Shaping Better Quality Places) (TAYplan, 2017).

20.6.37 A full policy compliance assessment can be found in Table 12 of *Appendix A21.1 (Assessment of Policy Compliance)*. It is assessed that although the proposed route options are anticipated to result in likely Negative health and wellbeing outcomes during construction, likely Positive and Neutral outcomes are assessed during operation of the proposed route options. In addition, one of the key objectives of the project is to improve the safety of the existing A9 for all users. As such policy compliance with national, regional and local policies related to Human Health is expected for all the proposed route options.

Community Objectives

20.6.38 The community objectives (refer to Volume 1, Part 3 – Environmental Assessment (Chapter 7: Overview of Environmental Assessment, Table 7.2)) have been considered throughout DMRB Stage 2. *Appendix A7.1: Mapping of Community Objectives Against DMRB Stage 2 Route Options* sets out which DMRB Stage 2 environmental topics are relevant to each of the Objectives.

20.6.39 A DMRB Stage 2 assessment of Human Health and mapping of the wellbeing related elements of the community objectives is reported in Volume 1, Part 3 – Environmental Assessment (Chapter 20: Human Health). Therefore, Volume 1, Part 3 – Environmental Assessment (Chapter 20: Human Health) is not reported in *Appendix A7.1: Mapping of Community Objectives Against DMRB Stage 2 Route Options*.

Comparative Assessment

20.6.40 Table 20.14 sets out the summary of the comparative assessment of the proposed route options for the construction phase. All proposed route options are assessed to have overall likely Negative health and wellbeing outcomes. Option ST2A would likely have the highest overall Negative outcome on health and wellbeing due to the nature and duration of the required construction activities, which would include extensive piling and excavation. Potential for adverse amenity effects in relation to noise, landscape amenity and accessibility for a longer duration were considered to be differentiators. Additionally, Option ST2C was considered to likely have the highest overall Negative outcome on health and wellbeing due to severance/separation from healthcare and recreation facilities during construction which may have a disproportionate effect on the young and the elderly, and was also considered a differentiator.

20.6.41 As Option ST2D has the least intrusive construction activities and the shortest construction period of 2.5 - 3 years, it would likely have the lowest overall Negative outcome on community health and wellbeing and was also therefore considered a differentiator. Option ST2B would likely have an intermediate overall Negative outcome on community health and wellbeing.

Table 20.14: Human Health Comparative Assessment - Construction

Route Option	Lowest Overall Effect	Intermediate Overall Effect	Highest Overall Effect
Option ST2A			✓
Option ST2B		✓	
Option ST2C			✓
Option ST2D	✓		

20.6.42 Table 20.15 sets out the summary of the comparative assessment of the proposed route options for the operational phase. Option ST2A is assessed to have the lowest overall likely outcomes (Positive) on health and wellbeing due to the potential opportunities for additional green space and landscape amenity, as well as improved amenity for NCN77, which are considered to be differentiators. Option ST2B, Option ST2C and Option ST2D are assessed to have intermediate overall likely outcomes (Neutral).

Table 20.15: Human Health Comparative Assessment – Operation

Route Option	Lowest Overall Effect	Intermediate Overall Effect	Highest Overall Effect
Option ST2A	✓		
Option ST2B		✓	
Option ST2C		✓	
Option ST2D		✓	

20.7 Scope of Stage 3 Assessment

20.7.1 It is proposed that the DMRB Stage 3 assessment for Human Health would be undertaken in accordance with the DMRB LA 112 'Population and Human Health', with the consideration of wellbeing included in the assessment.

20.7.2 It is anticipated the DMRB Stage 3 assessment would include the following:

- undertake additional consultation with the community, including issuing a health and wellbeing survey and utilising the survey data in the assessment;
- undertake consultation with the local authority and Public Health Consultant;
- identify potential health inequalities and disproportionate effects on vulnerable groups due to the proposed scheme;
- update the assessment of health and wellbeing outcomes taking into account the relevant assessments presented in other topics, based on the refined DMRB Stage 3 design;
- consider cumulative effects on health and wellbeing outcomes due to a number of changes to health and wellbeing determinants inter-acting with one another;
- determine significance of effects in relation to health and wellbeing outcomes;
- propose appropriate mitigation measures based on refined assessments; and
- identify any mitigation and monitoring measures required to reduce significant effects, including collaboration with the Population – Accessibility and Population – Land Use topics and other topics where relevant.

20.8 References

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21. Policies and Plans

21.1 Introduction

21.1.1 The Design Manual for Roads and Bridges (DMRB) Stage 2 assessment of the proposed route options in the context of national, regional and local planning policies is summarised in this chapter. This includes a review of national, regional and local planning policy and guidance documents, and consideration of potential policy conflicts or compliance of the proposed route options.

21.1.2 This chapter is supported by *Appendix A21.1: Assessment of Policy Compliance* which reports on Plans, Policies and Strategies (PPS) at national, regional and local levels which are relevant to the environmental assessments (Volume 1, Part 3 – Environmental Assessment, Chapters 8-20) of the proposed route options and provides an assessment of the extent to which the principle of the proposed route options is compliant with policy objectives.

Scottish Planning System

21.1.3 The 'Town and Country Planning (Scotland) Act 1997' (as amended by the Planning etc. (Scotland) Act 2006 and the Planning (Scotland) Act 2019) ['the Planning Act'] provides the framework for land use planning and the development of planning policy in Scotland.

21.1.4 A key feature of the Planning Act is the statutory role and application of the National Planning Framework (NPF). The National Planning Framework 3 (NPF3) contains a statement of priorities and a strategy for the long-term spatial development of Scotland (Scottish Government, 2014a). The approved NPF3 was published by the Scottish Government in June 2014 and identifies national developments including major strategic transport proposals. It also requires Scottish Ministers to include a statement of their reasons for considering a need for such developments.

21.1.5 The Scottish Government's influence on the planning system also extends to the production of Scottish Planning Policy (SPP), Circulars, Planning Advice Notes (PANs) and approval of strategic planning documents. Each of these policy documents is material to the development of local and regional policy and provides thematic guidance on planning for a broad range of land uses and developments.

21.1.6 Under the Planning Act, each planning authority in Scotland has a responsibility to publish a development plan, the content of which is informed by national policy. The development plan forms the basis on which decisions about development and future land use are made and incorporates the requirements of national planning policy within a strategic and local framework.

21.1.7 Development plans are comprised of a Strategic Development Plan (SDP) (prepared only for the four largest city regions), and Local Development Plan (LDPs) (prepared by each local authority for its area). The development plan is material to decisions about development and future land uses, including major infrastructure works such as the A9 dualling projects. This project is located within the Perth & Kinross Council (PKC) administrative area and as such the assessment of development plan policy compliance is based on policies from Perth & Kinross Local Development Plan 2 (PKC LDP2) which was adopted in November 2019 (PKC, 2019). In addition, relevant policies within the TAYplan strategic development plan (TAYplan, 2017) have been assessed as PKC is one of the authorities within the TAYplan city region (TAYplan is the Strategic Development Planning Authority for Dundee, Angus, Perth and North Fife). The relevant LDP documents are listed in Table 21.1.

21.1.8 Under the Planning (Scotland) Act 2019 Strategic Development Plans are no longer statutorily required to be provided as part of the development planning system. However, those which are currently in place, such as the TAYPlan, form part of the adopted development plan for the area until such time as a new local development plan is brought forward under the new system set out in the 2019 Act.

Table 21.1: Development Plan Documents

Document	Title	Status
Strategic Development Plan	TAYplan Strategic Development Plan (2016-36)	Approved October 2017
Local Development Plan	Perth and Kinross Local Development Plan 2 (PKC LDP2) (2019)	Adopted November 2019

21.2 Approach and Methods

21.2.1 The assessment at DMRB Stage 2 is in accordance with DMRB LA 104 'Environmental Assessment and Monitoring' (Highways England et al., 2020) which states that environmental assessment, reporting and monitoring shall meet the requirements of the national planning policy for each relevant Overseeing Organisation. In addition, DMRB LA 101, Introduction to Environmental Assessment (Highways England, Scottish Government, Welsh Government and the Department for Regional Development Northern Ireland, 2019) requires that project objectives and environmental objectives should deliver improved environmental performance by being linked and informed by wider legislative, regulatory or strategic requirements.

21.2.2 In accordance with this, policies and plans are reviewed in the context of national policy in relation to the principle of the scheme, and then more specific policy guidance for each of the environmental factor chapters (Volume 1, Part 3 – Environmental Assessment, Chapters 8 to 20). Policies and plans relevant to each factor chapter are presented in *Appendix A21.1 (Assessment of Policy Compliance)*. A summary of the compliance of the proposed route options for each environmental factor is provided in Section 21.4 (Summary of Assessment of Proposed Route Options Compliance) of this chapter.

21.2.3 The methodology used for this DMRB Stage 2 assessment has comprised the following:

- describing the existing and, where appropriate, emerging national planning policy guidance framework as applicable to the proposed route options;
- describing the existing, and where appropriate, emerging development plan framework as applicable to the proposed route options;
- assessing the likely impacts of the proposed route options on the achievement of the objectives and policies identified; and
- reporting the likely conflicts or compliance of the proposed route options on key national and local planning policy objectives.

Community Objectives

21.2.4 At an early stage in the A9 Co-Creative Process, the Birnam to Ballinluig A9 Community Group generated community objectives. The seven community objectives are presented in Volume 1, Part 3 – Environmental Assessment (Chapter 7: Overview of Environmental Assessment) and cover a wide range of factors but focus predominantly on environmental issues.

21.2.5 The community objectives have been taken into consideration throughout the DMRB Stage 2 process and a mapping exercise was conducted to indicate how, in the operational phase, the proposed route options could contribute to the relevant objectives. Details of how each environmental factor contributes towards achieving the community objectives is presented in *Appendix A7.1 (Mapping of Community Objectives Against DMRB Stage 2 Route Options)* and a summary is presented in Section 21.4 (Summary of Assessment of Proposed Route Options Compliance) in this chapter.

Limitations to Assessment

21.2.6 It should be noted that this DMRB Stage 2 assessment was prepared prior to and during the global COVID-19 coronavirus pandemic. Throughout 2020 and in early 2021, there have been significant and extensive restrictions in place in Scotland on the movement of people and the activities that are permitted. Due to the duration and extent of such restrictions, some of the baseline and survey updates for some environmental factors have not been achievable.

21.2.7 The assessment of compliance is based on the impact assessments reported in the environmental chapters. At the DMRB Stage 2 assessment, detailed mitigation to avoid or reduce impacts has not yet been developed, although suggested mitigation to be considered at DMRB Stage 3 is provided. In the absence of detailed design and mitigation, it is not possible to fully assess whether the proposed route options comply with each policy. Pre-mitigation, some impacts do not accord with policy, but compliance could be achieved with mitigation in place. This is a limitation on the assessment and *Appendix A21.1 (Assessment of Policy Compliance)* identifies where further review would be required at DMRB Stage 3.

21.3 Summary of Plans, Policies and Strategies

National Plans, Policies and Strategies

21.3.1 A summary of the national Plans, Policies and Strategies (PPS) as well as government framework documents of relevance to this project are provided below.

National Planning Framework 3 (NPF3) (Scottish Government, 2014a)

21.3.2 The Scottish Government published the third iteration of the NPF in June 2014. The NPF3 is a statutory document in relation to the production of development plans and a material consideration in planning decisions.

21.3.3 NPF3 guides Scotland's spatial development over the next 20 to 30 years setting out strategic development priorities to support the Scottish Government's central purpose to '*create a more successful country, with opportunities for all of Scotland to flourish, through increasing sustainable economic growth*.' (paragraph 1.1) One of the key drivers for the revision has been to emphasise placemaking. It also focusses on the following four outcomes for Scotland:

- a low carbon place;
- a natural, resilient place;
- a successful and sustainable place; and
- a connected place.

21.3.4 NPF3 describes spatial priorities for change in improving connections. It states in paragraph 5.20 that:

> *'The road network has an essential role to play in connecting cities by car, public transport and active travel…We will complete dualling of the trunk roads between cities, with dualling of the A9 from Perth to Inverness complete by 2025 and dualling of the A96 from Inverness to Aberdeen by 2030.'*

21.3.5 NPF3 states that the A9 dualling programme between Perth and Inverness will provide '*…a step change in accessibility across the rural north…*' and '*…increase business confidence and support investment through the region*.' (Scottish Government, 2014a, paragraph 5.32). Paragraph 4.28 of NPF3 notes that the improvements will also help enhance access to Scotland's National Parks, strengthening communities, investment and supporting tourism.

21.3.6 NPF3 identifies 14 major transport, energy and environmental infrastructure projects that are of national significance to Scotland (called national developments), and which are considered by Scottish Ministers

to be essential to the delivery of the spatial strategy set out in NPF3. These are new projects and do not include existing commitments such as the A9 Dualling Programme. They are considered to assist in contributing to the Scottish Government's objective of building a Scotland that is wealthier and fairer; greener; safer and stronger; smarter and healthier.

21.3.7 The National Long Distance Cycling and Walking Network is a national development identified within NPF3 which has direct relevance to the project.

21.3.8 A consultation draft of NPF4 was published in November 2021. NPF4 is a long-term spatial plan (to 2050) for Scotland that will align with the outcomes in the National Performance Framework and will set out where development and infrastructure is needed to support sustainable and inclusive growth. It will guide spatial development, set out national policies, designate national developments and reflect regional spatial priorities. As a draft, NPF4 may be subject to change through the consultation process, however its content is not expected to influence the selection of a route option and it has not been considered in the assessment at this stage, but it will be considered in more detail during DMRB Stage 3. Prior to the consultation of NPF4 a Position Statement was published in November 2020 (Scottish Government, 2020b), which set out ideas for changes to policy from NPF3 for four outcomes:

- A plan for Net-Zero Emissions;
- A Plan for Resilient Communities;
- A Plan for a Wellbeing Economy; and
- A Plan for Better, Greener Places.

Scottish Planning Policy (SPP) (Scottish Government, 2014b; Revised 2020)

21.3.9 SPP (Revised December 2020) describes the relationship between PPS from national to local level and illustrates how these are related to the Scottish Government's Purpose of '*creating a more successful country, with opportunities for all to flourish, through increasing sustainable economic growth*' (p.4). The framework of PPS is illustrated in SPP (refer to Diagram 21.1), however it should be noted that some of the PPS have been updated since this diagram was published in 2014. The policy assessment in *Appendix A21.1 (Assessment of Policy Compliance)* reports on current PPS in an assessment of the proposed route options compliance with national policy objectives.

21.3.10 Diagram 21.1 also illustrates how these national plans, policies and strategies (PPS) are relevant to, and inform, the development plan framework consisting of Strategic Development Plans and Local Development Plans. Local planning authorities are required to take into account the principal and subject based planning policies in SPP, and the provisions of the NPF3 (Scottish Government, 2014a) during the preparation of their statutory plans. However, this will be subject to change for future development plans with the forthcoming implementation of The Planning (Scotland) Act 2019 and future publication of NPF4.

21.3.11 The principal and relevant subject policies contained in SPP are summarised in Table 21.2.

Table 21.2: Scottish Planning Policy

Subject	SPP Paragraph	Summary
Introductory Sections	Paragraph 1 - 23	The introductory sections of the SPP set out a brief statement on the purpose of planning and detail the core principles that should underpin the modernised planning system. SPP states that successful operation of the planning system will only be achieved if all those involved commit themselves to engaging as constructively as possible in development planning and development management, so that the planning system contributes effectively to increasing sustainable economic growth.

Subject	SPP Paragraph	Summary
		It directs the form and content of Development Plans and is a material consideration in the assessment of planning applications. SPP sets out the core values and vision of planning and highlights the same four planning outcomes as NPF3. The outcomes are consistent across the NPF3 and SPP and focus on creating a place which is sustainable, low carbon, natural, resilient and more connected. The SPP sets out the two principal policies; Sustainability and Placemaking and then outlines various subject policies.
Sustainability	Paragraph 24 - 35	The SPP's central purpose is to focus government and public services on creating a more successful country through increasing sustainable economic growth. This can be achieved through the planning system by supporting economically, environmentally and socially sustainable places and responding to economic issues, challenges and opportunities. SPP states that policies and decisions should be guided by a number of key principles. These include: ▪ giving due weight to net economic benefit and responding to economic issues; ▪ supporting good design; ▪ making efficient use of existing capacities of land, buildings and infrastructure; ▪ supporting delivery of accessible housing, business, retailing and leisure development; ▪ supporting delivery of infrastructure, including transport, education, energy, digital and water; ▪ supporting climate change mitigation and adaptation including taking account of flood risk activity; ▪ having regard to principles for sustainable land use as set out in the Land Use Strategy; ▪ protecting, enhancing and promoting access to cultural heritage, including the historic environment; ▪ protecting, enhancing and promoting access to natural heritage, including green infrastructure, landscape and the wider environment; ▪ reducing waste, facilitating its management and promoting resource recovery; and ▪ avoiding over-development, protecting the amenity of new and existing development and considering the implications of development for water, air and soil quality.
Placemaking	Paragraph 36 -57	Placemaking is a creative, collaborative process that includes design, development, renewal or regeneration of our urban or rural built environments. Planning should take every opportunity to create high quality places by taking a design-led approach through the joint consideration of the relationships between higher quality places. Placemaking is supported through, amongst others, optimising the use of existing resources, using land within or adjacent to settlements for a mix of uses, developing brownfield land and locating development where investment in growth or improvement would have most benefit.
Promoting Rural Development	Paragraph 74 - 93	NPF sets out a vision for vibrant rural, coastal and island areas, with growing, sustainable communities supported by new opportunities for employment and education. To aid the delivery of this the planning system should: ▪ in all rural and island areas promote a pattern of development that is appropriate to the character of the particular rural area and the challenges it faces; ▪ encourage rural development that supports prosperous and sustainable communities and businesses whilst protecting and enhancing environmental quality; and ▪ support an integrated approach to coastal planning. In relation to prime agricultural land, or land of lesser quality that is locally important, development should not be considered except where it is essential as a component of the settlement strategy or necessary to meet an established need, for example for essential infrastructure, where no other suitable site is available.

Subject	SPP Paragraph	Summary
National Parks	Paragraph 84 - 86	National Parks are designated under the National Parks (Scotland) Act 2000 because they are areas of national importance for their natural and cultural heritage. The four aims of national parks are to: ▪ conserve and enhance the natural and cultural heritage of the area; ▪ promote sustainable use of the natural resources of the area; ▪ promote understanding and enjoyment (including enjoyment in the form of recreation) of the special qualities of the area by the public; and ▪ promote sustainable economic and social development of the area's communities. In relation to these aims, SPP advises the greatest weight should be given to the first aim.
Supporting Business and Employment	Paragraph 92 - 108	The planning system should continue the need for diversification of our rural economy to strengthen communities and retain young people in remote areas. Planning should address the development requirements of businesses and enable key opportunities for investment to be realised. It can support sustainable economic growth by providing a positive policy context for development that delivers economic benefits. Local development plans should locate development which generates significant freight movements, such as manufacturing, processing, distribution and warehousing, on sites accessible to suitable railheads or harbours or the strategic road network. Through appraisal, care should be taken in locating such development to minimise any impact on congested, inner urban and residential areas.
Valuing the Historic Environment	Paragraph 135 - 151	Recognises that the historic environment is a key cultural and economic asset for which planning has an important role to play in maintaining and enhancing distinctive and high-quality, irreplaceable historic places. Planning authorities should promote the care and protection of the designated and non-designated historic environment. This includes individual assets such as scheduled monuments and archaeological resources, listed buildings, conservation areas, sites in the Inventory of Historic Battlefields, Gardens and Designed Landscapes. The historic environment also includes the settings of such assets; and the wider cultural landscape. Positive change in the historic environment should be informed by a clear understanding of the importance of heritage assets and ensure their future use, and change should be sensitively managed to avoid or minimise adverse impacts on fabric or setting. With regards to listed buildings, SPP notes that 'special regard' should be given to the importance of preserving and enhancing a listed building, its setting, and any features of special architectural or historic interest. This term has a statutory meaning provided by Section 59 of the Planning (Listed Buildings and Conservation Areas) (Scotland) Act 1997 and is applicable to decisions on whether to grant planning permission. Chapter 14 (Cultural Heritage) provides further information on the provisions of this legislation. The policy in SPP is also accompanied by the Historic Environment Policy for Scotland (Historic Environment Scotland, 2019) and further guidance is provided in the Historic Environment Scotland 'Managing Change in the Historic Environment' guidance note series, both of which are summarised in Table 21.5 below.
Planning for Zero Waste	Paragraph 175 - 192	NPF3 recognises that waste is a resource and an opportunity, rather than a burden. Scotland has a Zero Waste Policy, which means wasting as little as possible and recognising that every item and material we use, either natural or manufactured, is a resource which has value for our economy. Planning plays a vital role in supporting the provision of facilities and infrastructure for future business development, investment and employment. To aid the delivery of this, the planning system should seek to conduct the following: ▪ promote developments that minimise the unnecessary use of primary materials and promote efficient use of secondary materials;

Subject	SPP Paragraph	Summary
		▪ support the emergence of a diverse range of new technologies and investment opportunities to secure economic value from secondary resources, including reuse, refurbishment, remanufacturing and reprocessing; ▪ support achievement of Scotland's zero waste targets: recycling 70% of household waste and sending no more than 5% of Scotland's annual waste arisings to landfill by 2025; and ▪ help deliver infrastructure at appropriate locations, prioritising development in line with the waste hierarchy: waste prevention, reuse, recycling, energy recovery and waste disposal.
Valuing the Natural Environment	Paragraph 193 - 218	Advises that planning authorities should conserve and enhance international, national and locally designated sites and protected species, taking account of the need to maintain healthy ecosystems and work with the natural processes which provide important services to communities. Plans should address potential effects of development on the natural environment and authorities should apply the precautionary principle where the impacts of a proposed development on nationally or internationally significant landscape or natural heritage resources are uncertain but there is sound evidence indicating that significant irreversible damage could occur.
Managing Flood Risk and Drainage	Paragraph 254 - 268	Sets out a precautionary approach to flood risk from all sources by safeguarding flood storage and conveying capacity. Planning authorities are required to take into account probability of flooding and associated risks when determining planning applications and preparing development plans, and developers should take flood risk into account prior to committing to development.
Promoting Sustainable Transport and Active Travel	Paragraph 269 - 291	Sets out the planning policy on sustainable transport to optimise the use of existing infrastructure and reduce the need to travel by providing safe and convenient opportunities for walking, cycling and travel by public transport. Development plans and development management decisions should also take account of the implications of development proposals on traffic, patterns of travel and road safety.

A National Mission with Local Impact – Infrastructure Investment Plan for Scotland 2021-22 to 2025-26 (Scottish Government, 2021)

21.3.12 The Infrastructure Investment Plan (IIP) outlines where capital invested in infrastructure will be spent and covers the period 2021-22 to 2025-26. It includes around £24 billion of major projects and large programmes which reflect the Scottish Government's vision for future infrastructure that '*supports Scotland's resilience and enables inclusive, net zero and sustainable growth*' (p.10). This vision is underpinned by three themes: Enabling the transition to net zero emissions and environmental sustainability; driving inclusive economic growth; and building resilient and sustainable places (p.6).

21.3.13 The IIP identifies the phased A9 Dualling Programme as a mechanism of delivering Theme 2 *Delivering Inclusive Economic Growth*, specifically *strengthening connectivity.*

21.3.14 Following from the recommendations made by the Infrastructure Commission for Scotland Phase 1:Key Findings Report (January 2020) the IIP has broadened the definition of infrastructure to include natural infrastructure, described as '*natural assets and networks that supply ecosystem services'* (page 8). These can include an area or system that is *'naturally occurring or naturalised and then intentionally managed to provide multiple benefits for the environment and human wellbeing'* (page 22). The IIP commits to investing in natural infrastructure and nature-based solutions to climate change, and the Scottish Government considers that its inclusion in the definition of infrastructure *'recognises the wider contribution natural capital can have towards creating sustainable, attractive places to live and improve wellbeing; generating economic growth and also reducing carbon emissions'* (page 23). Whilst the A9 Dualling Programme is a transport infrastructure investment which itself is continued to be committed

in the IIP, consideration of the impacts on natural infrastructure is integral to the design development process. This will continue to DMRB Stage 3 with further assessment of impacts and the development of landscape, ecological and water environment design and mitigation to create new natural infrastructure.

National Transport Strategy 2 (Transport Scotland, 2020)

21.3.15 In February 2020, a new National Transport Strategy (NTS) (NTS2) was published, setting out an updated vision for Scotland's transport system for the next 20 years (Transport Scotland, 2020) for '*a sustainable, inclusive, safe and accessible transport system, helping deliver a healthier, fairer and more prosperous Scotland for communities, businesses and visitors*' (p.2). The Vision is underpinned by four priorities:

- Reducing inequalities through the provision of fair, easy and affordable access to transport services;
- Taking climate action by ensuring Scotland's transport system helps deliver the Scottish Government's net-zero carbon emission target by 2045, adapts to the effects of climate change and promotes the use of sustainable travel options;
- Delivering inclusive economic growth by ensuring Scotland's transport network and services will be effectively integrated with spatial and land use planning and economic development, adapt to the changing requirements of citizens, businesses and visitors, provide reliable journey times, and use new and innovative products, services and technologies; and
- Improving health and wellbeing by prioritising the prevention and reduction of incidents, promoting active travel and creating cleaner and greener places and networks within the transport system.

21.3.16 NTS2 states that *'Overall, the transport system and the consideration of the current and future needs of people will be at the heart of planning decisions to ensure sustainable places. To help deliver this, we will continue to work collaboratively with partners to ensure that the Place Principle is applied and that all those responsible for providing services and looking after assets in a place work and plan together, and with local communities, to improve the lives of people'* (pages 59-60). The Scottish Government had previously agreed to adopt the Place Principle as an approach to encourage better collaboration and community involvement in place-based work, and this is being followed through in the publication of national plans and strategies including NTS2.

21.3.17 Overall, the proposed scheme is consistent with the aims and vision of NTS2. Specifically, the proposed scheme would be considered at the 2nd tier of the strategies '*Sustainable Investment Hierarchy*' as it involves '*Maintaining and safely operating existing assets*' (p.44). In addition, the proposed works are essential in ensuring '*a resilient and reliable transport system'* (p.41) that the strategy seeks to achieve.

21.3.18 Further, the engagement of the local community as part of the A9 Co-creative process (which predated publication of NTS2) and identification of community objectives and the Community's Preferred Route option is generally consistent with the Place Principle as now advocated through NTS2. Further information on the A9 Co-creative process is provided in Part 1 (The Scheme). It is anticipated that the Place Principle and concept of 'placemaking' will be continued as part of the DMRB Stage 3 assessment with further engagement of the community and other stakeholders in regard to design, environmental impacts and mitigation following the publication of DMRB Stage 2 Scheme Assessment Report and taking the preferred route option into DMRB Stage 3 assessment.

The Environment Strategy for Scotland: Vision and Outcomes (Scottish Government, 2020b)

21.3.19 The Environment Strategy provides an overarching framework bringing Scotland's existing strategies and plans on environmental issues such as climate change, biodiversity, circular economy, air and water quality together. Its vision is as follows:

> *'One Earth, One Home, One shared Future – By 2045: By restoring nature and ending Scotland's contribution to climate change, our country is transformed for the better – helping to secure the wellbeing of our people and planet for generations to come.'* (p.3)

21.3.20 The outcomes outlined by the strategy and of relevance to this project include:

- Scotland's nature is protected and restored with flourishing biodiversity and clean and healthy air, water, seas and soils;
- We play our full role in tackling the global climate emergency and limiting temperature rise to 1.5ºC;
- We use and re-use resources wisely and have ended the throw-away culture;
- Our thriving, sustainable economy conserves and grows our natural assets;
- Our healthy environment supports a fairer, healthier, more inclusive society; and
- We are responsible global citizens with a sustainable international footprint.

21.3.21 Compliance of the proposed route options with these outcomes is provided under the relevant discipline tables within *Appendix A21.1 (Assessment of Policy Compliance)*.

2020 Challenge for Scotland's Biodiversity (Scottish Government, 2013a)

21.3.22 The 2020 Challenge shows how the Scottish Government, its public agencies, Scottish business and others can contribute to the Strategy's aims as well as supporting sustainable economic growth. It is a supplement to the Scottish Biodiversity Strategy (2004) and together the two documents comprise the Scottish Biodiversity Strategy. Its place within the Scottish planning system can be seen in Diagram 21.1. Scotland's 2020 Challenge aims to:

- Protect and restore biodiversity on land and in our seas, and to support healthier ecosystems;
- Connect people with the natural world, for their health and wellbeing and to involve them more in decisions about their environment; and
- Maximise the benefits for Scotland of a diverse natural environment and the services it provides, contributing to sustainable economic growth.

21.3.23 A full policy assessment of the proposed scheme against these aims is provided in Table 4 (Biodiversity) of *Appendix 21.1 (Assessment of Policy Compliance)*, where it is concluded that there are areas of policy non-compliance due to potentially significant impacts upon fish species of conservation, however further assessment is required at DMRB Stage 3 to assess policy compliance of the proposed route options due to potential impacts upon designated sites, trees and woodland.

Climate Change Plan: third report on proposals and policies 2018-2032 (Scottish Government, 2018) and 2020 Update – Securing A green recovery on a path to net Zero (Scottish Government, 2020a)

21.3.24 The Climate Change Plan 2018 and the 2020 update provides the Scottish Government's policies and proposals for addressing climate change and achieving the emissions reduction targets set out in the Climate Change (Scotland) Act 2009. The update includes the updated emissions targets provided in the Climate Change (Emissions Reduction Targets) (Scotland) Act 2019 for net zero greenhouse gas emissions by 2045.

21.3.25 The updated plan seeks to reduce emissions from greenhouse gas emissions by 75% by 2030 and ultimately see net zero emissions by 2045. With respect to transport the vision of the plan is:

> '*By 2045, in line with our vision in NTS2, we will have a sustainable, inclusive, safe and accessible transport system, helping deliver a healthier, fairer and more prosperous Scotland for communities, business and visitors*'. (Section 3.3.18)

21.3.26 Although the objectives of the proposed scheme are not directly related to reducing emissions from transport, one of the objectives is to improve the safety of the existing A9 for all users. In addition, the National Planning Policy Assessment (*Appendix 21.1: Assessment of Policy Compliance*), outlines mitigation measures which have been proposed in relevant Environment Assessment chapters in order to reduce impacts upon the natural environment. Volume 1, Part 3 – Environmental Assessment (Chapter 19: Climate) of this EIAR provides an assessment of the potential impact of the proposed route options on climate change. While it is anticipated that there will be an increase in GHG emissions because of the proposed route options, the magnitude of the additional GHG emissions is predicted to be negligible when compared to the UK carbon budgets and the Scottish Government interim targets.

Scotland's Economic Strategy (Scottish Government, 2015a)

21.3.27 The current Economic Strategy, published in 2015 states that the purpose of the Scottish Government is to create a more successful country, through increasing sustainable economic growth and tackling inequality. The Strategy was initially published in 2007, revised in 2011 in cognisance of the economic downturn and updated in 2015. The update focuses on creating a more successful country, through increased competitiveness and sustainability of the Scottish economy. The strategy is based on the principle that investing in infrastructure is key to helping businesses to grow, innovate and create good quality employment opportunities.

21.3.28 The strategy acknowledges the importance of Scotland's cities and towns as centres of growth and prosperity. With regards to investment in infrastructure the strategy states that it '*is key to driving long-term improvements in competitiveness and in creating opportunities for everyone in society to benefit from these improvements*' (p.37). The A9 dualling programme is listed in the Economic Strategy as a major project which will help cities, towns and regions to drive growth and compete internationally.

A Long-Term Vision for Active Travel in Scotland 2030 (Transport Scotland, 2014a)

21.3.29 Transport Scotland's Vision for Active Travel aims to encourage more people to walk and cycle for everyday shorter journeys. It focuses on areas such as infrastructure, transport integration, cultural and behaviour change, community ownership and planning.

21.3.30 With regards to infrastructure, The Transport Scotland vision seeks to ensure:

> *'Comprehensive active travel networks are available for walking and cycling…*
>
> *Nationally, walking and cycling networks (comprising the National Cycle Network, Long Distance Routes (LDRs), regional routes, core paths and local cycle networks) link settlements, places of interest and public transport hubs.' (p.7)*

Fitting Landscapes: Securing More Sustainable Landscapes (Transport Scotland, 2014b)

21.3.31 Transport Scotland has produced '*Fitting Landscapes*' guidance which has the overarching vision to:

> *'promote the more sustainable design, implementation, maintenance and management of the transport estate and ensure that the landscapes we create and manage are of high quality, well integrated, bio-diverse, adaptable and deliver a meaningful contribution to national sustainability targets.' (p.12)*

21.3.32 The guidance has been incorporated into the landscape and visual assessments of the proposed route options as reported in Volume 1, Part 3 – Environmental Assessment (Chapter 12: Landscape and Chapter 13: Visual).

Strategic Transport Projects Review – Final Report (STPR) (Transport Scotland, 2009)

21.3.33 The STPR (Final Report) supports the delivery of strategic outcomes identified in the previous iterations of the National Transport Strategy (2006) and National Planning Framework 2 (2010), both of which have been superseded. The outcomes of the STPR are structured on a tiered approach to investment. Maintaining safe, efficient and effective links on strategic corridors, including the A9, is seen as one of the key challenges of the STPR.

21.3.34 STPR set out 29 investment priorities within a hierarchy for the 20-year period following the publication of the programme. Intervention 16 – A9 Upgrading from Dunblane to Inverness considers the dualling and wider improvements to the A9, as part of this project. In relation to this project, the STPR recognises that:

> *'The A9 between Perth and Blair Atholl is the most heavily trafficked section of the A9 north of Perth. Dualling this section would have the most significant impact on reducing journey times and improving journey time reliability. This would also contribute to a consistent carriageway standard along this section of the A9.'* (p.100)

21.3.35 In terms of future network performance, the review categorises the strategic transport network into 20 corridors, four urban networks (Glasgow, Edinburgh, Dundee and Aberdeen), and two strategic nodes (Perth and Inverness). Effective transport was identified as being key to support the delivery of Scotland's Economic Strategy (refer to paragraphs 21.3.27 and 21.3.28). The review concluded that generally the network was performing to a high standard however a number of significant areas would require specific attention, this included the following objectives in relation to 'Corridor 6 – Inverness to Perth':

- *'To reduce journey time and increase opportunities to travel between Inverness and Perth (and hence onwards to the Central Belt);*
- *To improve the operational effectiveness of the A9 as it approaches Perth and Inverness;*
- *To address issues of driver frustration relating to inconsistent road standard, with attention to reducing accident severity; and*
- *To promote journey time reductions, particularly by public transport, between the Central Belt and Inverness primarily to allow business to achieve an effective working day when travelling between these centres' (p. 143)*

Planning Advice Notes and Circulars

21.3.36 Planning Advice Notes (PANs) support SPP and provide advice on good practice. A summary of PANs of relevance to the project is provided in Table 21.3.

Table 21.3: Relevant Planning Advice Notes

PAN	Title	Description
PAN 33	Development of Contaminated Land (Scottish Government, 2017a)	Provides advice on the implications of the contaminated land regime for the planning system; and the development of, and approach to, contaminated land in development plans. It also contains guidance on the determination of planning applications when the site is, or may be, contaminated.
PAN 51	Planning, Environmental Protection and Regulation (Revised 2006) (Scottish Executive, 2006a)	Supports the existing policy on the role of the planning system in relation to the environmental protection regimes. This PAN also summarises the statutory responsibilities of the environmental protection bodies, as well as informing these bodies about the planning system.

PAN	Title	Description
PAN 60	Planning for Natural Heritage (Scottish Executive, 2000)	Provides advice on how development and the planning system can contribute to the conservation, enhancement, enjoyment and understanding of Scotland's natural environment and encourages developers and planning authorities to be positive and creative in addressing natural heritage issues. It complements the SPP, with examples of good planning practice in relation to natural heritage drawn from across Scotland highlighted in a number of case studies.
PAN 61	Planning and Sustainable Urban Drainage Systems (Scottish Executive, 2001)	Provides good practice advice for planners and the development industry on the implementation of Sustainable Urban Drainage Systems (SuDS) (now referred to as Sustainable Drainage Systems in latest guidance) to aid the introduction of more sustainable developments.
PAN 65	Planning and Open Space (Scottish Government, 2008)	Provides advice on the role of the planning system in protecting and enhancing existing open spaces and providing high quality new spaces. The advice relates to open space in settlements: villages, towns and major urban areas.
PAN 75	Planning for Transport (Scottish Executive, 2005)	Aims to create greater awareness of how linkages between planning and transport can be managed. It highlights the roles of different bodies and professions in the process and points to other sources of information on the overlap of the two sectors.
PAN 78	Inclusive Design (Scottish Executive, 2006b)	Supports the Government's aim of promoting more equality in the areas where we live and work. The PAN aims to explain the importance of inclusive design, identify the nature of the problems experienced in designing inclusive environments and describe the legislative context. It also outlines the roles of the different stakeholders in delivering inclusive design and identifies the particular challenges of applying inclusive design to the historic environment.
PAN 79	Water and Drainage (Scottish Executive, 2006c)	Clarifies the role of the planning authority in setting the direction of development to inform the planning and delivery of new water infrastructure in a coordinated way. It explains the roles of Scottish Water and the Scottish Environment Protection Agency and encourages joint working in order to ensure a common understanding of capacity constraints and agreement on the means of their removal. It advises on the appropriateness of private schemes and the handling of Scottish Water developments.
PAN 3/2010	Community Engagement (Scottish Government, 2010a)	The PAN provides advice to communities on how they can get involved and advice to planning authorities and developers on ways of effectively engaging with communities on planning matters. It advocates the use of 10 National Standards for the delivery of effective community engagement in land use plan, providing detailed advice on each standard as follows: Involvement; Support; Planning; Methods; Working Together; Sharing Information; Working with Others; Improvement; Feedback; and Monitoring and Evaluation.
PAN 1/2011	Planning and Noise (Scottish Government, 2011a)	The PAN promotes the principles of good acoustic design and a sensitive approach to the location of new development. It promotes the appropriate location of new potentially noisy development, and a pragmatic approach to the location of new development within the vicinity of existing noise generating uses, to ensure that quality of life is not unreasonably affected, and that new development continues to support sustainable economic growth.
PAN2/2011	Planning and Archaeology (Scottish Government, 2011b)	This PAN accompanies SPP, HEPS and the Managing Change in the Historic Environment Guidance Notes, which together set out national policies and guidance for planning and the historic environment. It is intended to inform the day-to-day work of a range of local authority advisory services and other organisations that have a role in the handling of archaeological matters within the planning process.
PAN1/2013 (Rev. 1)	Environmental Impact Assessment (Revised 2017) (Scottish	Updated guidance to reflect 2017 regulations, containing advice on the integration of EIA procedures into the overall development management process. This is of relevance as there is no guidance specific to EIAs produced under the Roads (Scotland) Act 1984 (Environmental Impact Assessment) Regulations 2017.

PAN	Title	Description
	Government, 2013b)	

21.3.37 Table 21.4 contains relevant Planning Circulars which provide statements of Scottish Government policy and guidance on implementation and/or procedural change.

Table 21.4: Planning Circulars

Circular	Title	Description
18/1987	Development Involving Agricultural Land (amended by 29/1988 and 25/1994) (Scottish Executive, 1987)	Defines the general policy aim as being to conserve agricultural land in a situation of considerable shortfalls in basic commodities. The aim of this policy is reflected within the aspirations of SPP through '*Promoting Rural Development*'.
1/2013	Strategic Development Plan Areas (SDPA) (Scottish Government, 2013c)	This Circular sets out the boundaries of the four Strategic Development Plan Areas in Scotland. It includes revisions made to the boundaries following from the incorporation of parts of Perth & Kinross Council area to the Cairngorms National Park. Perth & Kinross Council area remains part of the Dundee, Perth Angus and Fife SDP Area. The part of Perth & Kinross Council area now included within the Cairngorms National Park is excluded from the SDPA.
1/2017	The Town and Country Planning (EIA) (Scotland) Regulations 2017 (Scottish Government, 2017b)	This Circular gives guidance on the Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2017, ('the 2017 Regulations'), as the latest Regulations which transpose the Environmental Impact Assessment or 'EIA' Directive into the Scottish planning system. There is no equivalent circular for the Roads (Scotland) Act 1984 (Environmental Impact Assessment) Regulations 2017.

21.3.38 An overview of other national planning policy and guidance is provided in Table 21.5.

Table 21.5: Other Relevant National Policy Guidance

Title	Description
Historic Environment Policy for Scotland (HEPS) (Historic Environment Scotland, 2019)	The policy provides direction on decision-making that affects the historic environment. There are six policies for managing the historic environment, which are: 1. Decisions affecting the historic environment should be informed by an inclusive understanding of its breadth and cultural significance. 2. Decisions affecting the historic environment should ensure that its understanding and enjoyment as well as its benefits are secured for present and future generations. 3. Plans, programmes, policies and strategies and the allocation of resources should be approached in a way that protects and promotes the historic environment. If detrimental impact on the historic environment is unavoidable, it should be minimised. Steps should be taken to demonstrate that alternatives have been explored, and mitigation measures should be put in place. 4. Changes to specific assets and their context should be managed in a way that protects the historic environment. Opportunities for enhancement should be identified where appropriate. If detrimental impact on the historic environment is unavoidable, it should be minimised. Steps should be taken to demonstrate that alternatives have been explored, and mitigation measures should be put in place.

Title	Description
	5. Decisions affecting the historic environment should contribute to the sustainable development of communities and places. 6. Decisions affecting the historic environment should be informed by an inclusive understanding of the potential consequences for people and communities. Decision making processes should be collaborative, open, transparent and easy to understand.
Managing Change in the Historic Environment (Historic Environment Scotland, 2010-2019)	The series provides best practice advice for applying the policies of the Historic Environment Policy for Scotland (2019) and Scottish Planning Policy (2014b; Revised 2020). The guidance notes that are of relevance to the study area for the proposed route options are '*Setting*', '*Gardens and Designed Landscapes', 'Conservation Areas', and 'Listed Buildings'*.
Scotland's Zero Waste Plan (Scottish Government, 2010b)	Sets out the Scottish Government's vision for a zero waste society. This vision describes a Scotland where all waste is seen as a resource; waste is minimised; valuable resources are not disposed of in landfills, and most waste is sorted, leaving only limited amounts to be treated.
Planning and Waste Management Advice (Scottish Government, 2015b)	Complements NPF3, SPP and Scotland's Zero Waste Plan. A low carbon place and 'circular economy' are alternatives to the 'make, use, dispose' culture which means re-using products and materials continually and growing a low carbon economy.
Online Planning Advice on Flood Risk (Scottish Government, 2015c)	PAN 69: Planning and Building Standards Advice on Flooding (Scottish Executive, 2004) has been superseded with Online Planning Advice. The advice provides guidance to reflect The Flood Risk Management (Scotland) Act 2009. The Act establishes a framework for the assessment and sustainable management of flood risk with the aim of reducing the adverse consequences of flooding from all sources.
Our Place in Time - The Historic Environment Strategy for Scotland (Scottish Government, 2014c)	Scotland's first ever Historic Environment Strategy is a high-level framework which sets out a 10 year vision for the historic environment. The key outcome is to ensure that the cultural, social, environmental and economic value of Scotland's historic environment continues to make a strong contribution to the wellbeing of the nation and its people. It was developed collaboratively and identified the need for strategic priorities to help align and prioritise sector activity towards a common goal.

Regional and Local Planning Policy

TAYplan Strategic Development Plan (SDP) 2016-2036 (TAYplan, 2017)

21.3.39 TAYplan is the Strategic Planning Authority for the Dundee, Perth, Angus and North Fife area. The SDP was approved in 2017.

21.3.40 The vision for the SDP is that:

> *'By 2036, the TAYplan area will be sustainable, more attractive, competitive and vibrant without creating an unacceptable burden on our planet. The quality of life will make it a place of first choice where more people choose to live, work, study and visit and where businesses choose to invest and create jobs.' (TAYplan, 2017. p.4.)*

21.3.41 In support of this vision, the key outcomes of the SDP are to create an area where:

- '*more people are healthier;*
- *through sustainable economic growth the region's image will be enhanced;*
- *we live, work and play in better quality environments;*

- *we live within Earth's environmental limits.'*

21.3.42 The SDP identifies the dualling of the A9 as one of a number of national projects which will help to '*improve journey times within the TAYplan region'* and it requires land to be safeguarded for infrastructure identified in the Strategic Transport Projects Review, which includes the A9 dualling programme (TAYplan, 2017. p.59).

21.3.43 Ten thematic policies are covered within the SDP as follows:

- Policy 1 – Location Priorities;
- Policy 2 – Shaping better quality places;
- Policy 3 – A First Choice for Investment;
- Policy 4 – Homes;
- Policy 5 – Town Centres First;
- Policy 6 – Developer Contributions;
- Policy 7 – Energy, Waste and Resources;
- Policy 8 – Green Networks;
- Policy 9 – Managing TAYplan's Assets; and
- Policy 10 – Connecting People, Places and Markets.

Perth & Kinross Local Development Plan 2 (PKC LDP2) (PKC, 2019)

21.3.44 The Perth and Kinross Local Development Plan 2 (PKC LDP2) was adopted on 29 November 2019.

21.3.45 The overarching vision of PKC LDP2 mirrors that of the TAYplan:

> *'…The TAYplan area will be sustainable, more attractive, competitive and vibrant without creating an unacceptable burden on our planet. The quality of life will make it a place of first choice where more people choose to live, work, study and visit and where business choose to invest and create jobs.' (TAYplan, 2016-2036, Strategic Development Plan, p.4)*

21.3.46 The key objectives of PKC LDP2 focus on creating high-quality places that meet the needs of the existing communities as well as enhancing its natural assets and cultural heritage. In terms of natural assets, the PKC LDP2 seeks to protect habitats, green networks, recreational space and protected species. Growth should therefore be sympathetic to the landscape in which it is set and should not place an unnecessary burden on the environment. PKC LDP2 also makes the commitment to tackle climate change and reduce carbon emissions.

21.3.47 The PKC LDP2 promotes the delivery of local and strategic transport infrastructure to support the sustainable development of the area.

21.3.48 An assessment of the compliance of the proposed route options in relation to the policies in the LDP is provided in *Appendix A21.1 (Assessment of Policy Compliance)* and is summarised in Section 21.4 (Summary of Assessment of Proposed Route Options Compliance) of this chapter.

Regional and Local Transport Strategy

21.3.49 The relevant Regional Transport Strategy for the project is described in paragraph 21.3.50. There is no Local Transport Strategy applicable to the project.

TACTRAN Regional Transport Strategy Refresh 2015 - 2036 (TACTRAN, 2015)

21.3.50 TACTRAN has responsibility for the preparation and delivery of the regional transport strategy (RTS). The RTS Refresh updates policies and proposals from the previous 2008 RTS and identifies 31 Strategic Actions aimed at supporting regional economic prosperity; connecting our communities and being socially inclusive; and promoting environmental sustainability and improved health and wellbeing. The forecast period for the RTS up to 2036 aligns with the second TAYplan Strategic Development Plan covering much of the TACTRAN area.

Diagram 21.1 - Relationship of Plans, Policies & Strategies in Scotland (Scottish Government, 2014b; Revised 2020)

<table>
<tr><td>Scottish Government Purpose</td><td colspan="11">To focus government and public services on creating a more successful country, with opportunities for all to flourish, through increasing sustainable economic growth.</td></tr>
<tr><td>Scottish Government National Outcomes</td><td colspan="11">The planning system and service contribute to all 16 National Outcomes</td></tr>
<tr><td rowspan="3">Scottish Government National Plans, Policies & Strategies</td><td colspan="11">Government Economic Strategy</td></tr>
<tr><td colspan="11">Infrastructure Investment Plan</td></tr>
<tr><td>Scotland's Digital Future</td><td>Electricity & heat generation policy Statements</td><td>2020 Challenge for Scotland's Biodiversity</td><td>Scottish Historic Environment Strategy and Policy</td><td>Housing Strategy</td><td>National Planning Framework & Scottish Planning Policy</td><td>Land Use Strategy</td><td>Low carbon Scotland: report of Proposals and Policies</td><td>National Marine Plan</td><td>Regeneration Strategy</td><td>National Transport Strategy</td></tr>
<tr><td>Planning Vision</td><td colspan="11">We live in a Scotland with a growing, low carbon economy with progressively narrowing disparities in well-being and opportunity. It is growth that can be achieved whilst reducing emissions and which respects the quality of environment, place and life which makes our country so special. It is growth which increases solidarity – reducing inequalities between our regions. We live in sustainable, well-designed places and homes which meet our needs. We enjoy excellent transport and digital connections, internally and with the rest of the world.</td></tr>
<tr><td>Planning Outcomes</td><td colspan="3">Planning makes Scotland a successful, sustainable place – supporting sustainable economic growth and regeneration, and the creation of well-designed places.</td><td colspan="3">Planning makes Scotland a low carbon place – reducing our carbon emissions and adapting to climate change.</td><td colspan="3">Planning makes Scotland a natural, resilient place – helping to protect and enhance our natural and cultural assets, and facilitating their sustainable use.</td><td colspan="2">Planning makes Scotland a connected place – supporting better transport and digital connectivity.</td></tr>
<tr><td rowspan="6">National Planning</td><td colspan="6">Scottish Planning Policy (SPP)</td><td colspan="6" rowspan="2">National Planning Framework (NPF)</td></tr>
<tr><td colspan="3">Principal Policies</td><td colspan="3">Placemaking</td></tr>
<tr><td colspan="6">Subject Policies</td><td rowspan="4"></td><td rowspan="4"></td><td rowspan="4">Cities and Towns
Rural Areas
Coast and Islands
National Developments</td><td rowspan="4"></td><td rowspan="4"></td></tr>
<tr><td>Town Centres
Rural Development
Homes</td><td rowspan="2">Heat and Electricity</td><td>Natural Environment
Green Infrastructure</td><td rowspan="2">Travel</td></tr>
<tr><td>Business & Employment
Historic Environment</td><td rowspan="2">Zero waste</td><td>Aquacultural
Minerals
Flooding & Drainage</td><td>Digital Connectivity</td></tr>
<tr><td></td><td colspan="11">Community Planning</td></tr>
<tr><td>Strategic</td><td colspan="11">Strategic Development Plans</td></tr>
<tr><td>Local</td><td colspan="11">Local Development Plans</td></tr>
<tr><td>Site</td><td colspan="11">Master Plans</td></tr>
</table>

21.4 Summary of Assessment of Proposed Route Options Compliance

21.4.1 An assessment of the compliance of each proposed route option against national, regional and local development planning policies is provided in *Appendix A21.1 (Assessment of Policy Compliance)*. This section provides a summary of the compliance assessment with reference to key policy themes.

The Project: Key Policy Principles

National Policy

21.4.2 The project, as part of the A9 dualling programme, is a commitment of Scottish Ministers referenced in national policy and plans including the Infrastructure Investment Plan and NPF3. It would contribute to the overall objectives of reducing journey times, improving operational effectiveness and increasing safety, which in turn is consistent with national policy in seeking to improve connectivity between places and support sustainable economic growth.

21.4.3 However, there are areas of likely non-compliance with national policy principles, including SPP's *Valuing the Natural Environment* and *Valuing the Historic Environment*, of relevance to Volume 1, Part 3 – Environmental Assessment (Chapter 10: Road Drainage and the Water Environment; Chapter 11: Biodiversity; and Chapter 14: Cultural Heritage). These are related to impacts and effects upon private property, housing and business, agricultural land and woodland, hydromorphology and surface water quality, fish species of conservation interest, the Category A listed Dunkeld & Birnam Station and the Murthly 'Gardens and Designed Landscape'.

21.4.4 It is assessed that the differentiators between the proposed routes options, in national policy compliance terms, are in relation to Road Drainage and the Water Environment and Biodiversity assessments.

Regional Policy

21.4.5 The primary objective of the TAYplan Strategic Development Plan (SDP) is to promote economic growth, whilst safeguarding and enhancing the natural and built environment and promoting overall sustainability. The overall vision and aims of this plan are to achieve a more sustainable pattern of development by providing a framework within which the key elements of the built and natural environment can be protected and enhanced.

21.4.6 The dualling of the existing A9 accords with the overall strategy and objectives of the SDP, which identifies the planned improvements to the existing A9 on the Proposal Map. It is stated that the planned national and regional transport infrastructure improvements identified in the SDP will support a stronger economy and will contribute towards delivering the objectives of the SDP.

21.4.7 In terms of transport policy, the TACTRAN RTS indicates that delays to movement on strategic roads occur mainly on single carriageway sections of trunk roads. As mentioned in paragraph 21.3.50 the RTS sets out a key vision for the region and was developed in alignment with RTS and Scottish Transport Appraisal Guidance (STAG).

21.4.8 In terms of economic growth, the TAYplan SDP and RTS seek to improve the strategic infrastructure necessary to enable the economy to grow over the long term. The Objectives, set out in Appendix A of the TACTRAN, have weightings attached to demonstrate their priority. The highest weighted objective (Objective 2) seeks '*To improve the efficiency, reliability and integration of the movement of goods and people*' (p.17) which the project will seek to achieve.

Local Policy

21.4.9 In principle, the proposals support the objectives of local plan policy. PKC LDP2 promotes the delivery of infrastructure, through regional transport strategies (paragraph 21.3.50) and the creation of well served public and private investment opportunities appropriate to the area's needs. It is stated in PKC LDP2 that, '*The biggest single constraint facing the Perth Area is the capacity of the roads infrastructure in and around Perth*' (2019, p.256) while Policy 60A (Existing Infrastructure) of PKC LDP2 (Transport and Accessibility) states that, '*The plan identifies existing transport infrastructure; encouragement will be given to the retention and improvement of these facilities*' (p.102). The plan emphasises that the delivery of infrastructure is crucial, stating that '*ensuring that both local and strategic transport infrastructure is in place to support the sustainable development of Perth and Kinross is critical to the success of the Plan strategy*' (p.97). The delivery of the A9 dualling programme will provide a significant contribution to alleviate constraints and improve the overall road infrastructure in the region while helping to promote economic growth.

21.4.10 Therefore, the principle of all proposed route options supports the objectives set out in local policy.

Environmental Factor Summary of Assessment

21.4.11 An assessment of the compliance of the proposed route options with national to local PPS has been undertaken with reference to the assessment of potential environmental impacts reported in this DMRB Stage 2 assessment. A detailed assessment of compliance of the proposed route options with national and local policy and guidance is provided in *Appendix A21.1 (Assessment of Policy Compliance)*. A summary of the outcome of the compliance assessment in relation to each environmental factor is provided in Table 21.6.

21.4.12 Table 21.6 provides a summary of the outcome of this assessment for each proposed route option. It identifies whether each proposed route option is broadly compliant with all policy ('✓'); may pose non-compliance issues ('X'); or requires further assessment during DMRB Stage 3 ('?'). In circumstances where, notwithstanding the overall assessment findings for the environmental factor area, a specific area of non-compliance is identified for a specific element, this is indicated in brackets by ('x').

Table 21.6: Summary of Compliance

Relevant Environmental Assessment Chapters	Option ST2A	Option ST2B	Option ST2C	Option ST2D
8: Population – Land Use	?	?	?	?
9: Geology, Soils and Groundwater	?	?	?	?
10: Road Drainage and the Water Environment	✓ (x)	✓ (x)	✓	✓
11: Biodiversity	?(x)	?(x)	?	?
12: Landscape	?(x)	?(x)	?(x)	?(x)
13: Visual	?(x)	?(x)	?(x)	?(x)
14: Cultural Heritage	?(x)	?(x)	?(x)	?(x)
15: Air Quality	?	?	?	?
16: Noise and Vibration	?	?	?	?
17: Population – Accessibility	?	?	?	?

Relevant Environmental Assessment Chapters	Option ST2A	Option ST2B	Option ST2C	Option ST2D
18: Material Assets and waste	✓	✓	✓	✓
19: Climate	✓	✓	✓	✓
20: Human Health	✓	✓	✓	✓

21.4.13 The main environmental impacts and effects that result in non-compliance with national to local policy are of relevance to four environmental factors assessed in Volume 1, Part 3 – Environmental Assessment, these being Population – Land Use (Chapter 8); Road Drainage and the Water Environment (Chapter 10), Biodiversity (Chapter 11), and Cultural Heritage (Chapter 14).

21.4.14 As a result of potential effects upon private property & housing and businesses as well as land-take from non-prime and prime agricultural land and woodland, Chapter 8 (Population – Land Use) is assessed to be non-compliant with relevant national to local policy.

21.4.15 In relation to Chapter 10 (Road Drainage and the Water Environment), hydromorphology and surface water quality impacts upon Inchewan Burn as a result of Options ST2A and ST2B would result in non-compliance with national to local policy due to the irreversible nature of the effects. In addition, policy non-compliance with Chapter 11 (Biodiversity) is assessed due to the significant effects upon fish species of conservation interest as a result of Options ST2A and ST2B.

21.4.16 In addition, non-compliance is assessed for Chapter 14 (Cultural Heritage) due to the potential effects on the Category A listed Dunkeld & Birnam Station, and the Murthly Castle designed landscape as a result of all proposed route options.

21.4.17 In conclusion, the differences in terms of policy compliance between the proposed route options are not sufficient to be considered differentiators with the exception of those policies relating to Road Drainage and the Water Environment and Biodiversity. The differences in policy compliance in relation to Road Drainage and the Water Environment and Biodiversity are considered sufficient to be differentiators between proposed route options.

21.4.18 At DMRB Stage 2, the proposed route options have not been subject to detailed design or mitigation and which would influence the assessment of policy compliance, particularly for those environmental factors assessed as '?' in Table 21.6. Further assessment would be undertaken at DMRB Stage 3 when the design of the Preferred Route Option and mitigation measures have been developed.

Community Objectives

21.4.19 Taking into consideration how the DMRB Stage 2 assessments and proposed route options can contribute to the community objectives as detailed in *Appendix A7.1: Mapping of Community Objectives Against DMRB Stage 2 Route Options*, there are no specific contributions to meeting the community objectives identified for Policies and Plans.

Comparative Assessment

21.4.20 Whilst the majority of policy compliance assessments are consistent across the proposed route options, it is assessed that the main differences between the proposed route options, in policy compliance terms, are in relation to Road Drainage and the Water Environment and Biodiversity assessments which are considered sufficient to be differentiators between the proposed route options. As shown in Table 21.7, Option ST2C and Option ST2D are considered to adhere greater with policy objectives than Option ST2A

and Option ST2B due to differential hydromorphology and surface water quality impacts upon Inchewan Burn and impacts upon fish species of conservation interest.

21.4.21 Policy non-compliance in relation to Population – Land Use and Cultural Heritage are consistent across the proposed route options and as such the differences are not considered sufficient to be a differentiator between the proposed route options.

Table 21.7: Policies and Plans Comparative Assessment

Route Option	Lowest Overall Effect (Highest Level of Policy Compliance)	Intermediate Overall Effect	Highest Overall Effect (Lowest Level of Policy Compliance)
Option ST2A			✓
Option ST2B			✓
Option ST2C	✓		
Option ST2D	✓		

21.5 Scope of Stage 3 Assessment

21.5.1 It is proposed that the DMRB Stage 3 assessment for Policies and Plans, similar to this DMRB Stage 2 assessment, would review compliance of the Preferred Route Option with national and local policies and plans. The DMRB Stage 3 assessment would not include a Policies and Plans chapter, similar to this chapter, due to the provision of a Need for the Scheme chapter which would outline the policy context surrounding the principle of the scheme. An assessment of policy compliance of the Preferred Route Option would be undertaken in a separate appendix with summaries provided in each of the environmental factor chapters. In addition, further assessment would be undertaken at DMRB Stage 3 when the design of the Preferred Route Option and mitigation measures have been developed in order to complete the assessment of compliance of environmental assessment chapters which were marked with a '?' at this stage.

21.6 References

Legislation

Climate Change (Emissions Reduction Targets) (Scotland) Act 2019

Climate Change (Scotland) Act 2009

Planning etc. (Scotland) Act 2006

Roads (Scotland) Act 1984 (Environmental Impact Assessment) Regulations 2017

The Flood Risk Management (Scotland) Act 2009

The Planning (Scotland) Act 2019

Town and Country Planning (Scotland) Act 1997

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