18. Materials

18.1. Introduction

18.1.1. This chapter includes an assessment of anticipated impacts:

- from the material resource demand from primary and secondary sources and manufactured construction products during site preparation and construction of the Proposed Scheme (as described in Chapter 5: The Proposed Scheme); and
- to waste facilities in the surrounding area as a result of the site preparation and construction of the Proposed Scheme.

18.1.2. This assessment addresses 'materials' in accordance with the aims and objectives of DMRB, Volume 11, Part 1: HA 200/08[i] which identifies 'materials' as an Environmental Impact Assessment (EIA) topic to be assessed.

18.1.3. The assessment of materials and waste impacts has been carried out in accordance with draft DMRB Volume 11, Section 3, Part 6 HD212/11(HD212/11)[ii].

18.1.4. In line with HD212/11, detailed assessment has been undertaken and this has allowed the simple assessment carried out at DMRB Stage 2 to be updated and refined where relevant, updated information is available. The Stage 3 assessment has primarily focused on environmental impacts from construction from: depletion of natural resources; embodied carbon emissions associated with the production of materials; the generation and management of waste on site; and the potential impact on waste policies and available waste management facilities.

18.1.5. Within HD212/11 and this report, the term 'materials' is defined as relating to Materials Resources used and consumed by the construction, improvement and maintenance of roads.

18.1.6. In line with the Waste Framework Directive (2008/98/EC)[iii], "waste" is considered to be "*any substance or object set out in Annex 1 of the Directive which the holder discards or intends to discard or is required to discard*".

18.1.7. With regards to mitigation, it is an objective of this assessment to improve the sustainability in design and construction and to address this from the earliest possible design stage. There are also opportunities to incorporate mitigation measures into the construction phase and these will allow the sustainability of a project to be maximised and residual impacts to be minimised. Detailed mitigation measures relating to the construction phase are specified in Section 18.5.

18.1.8. Implementing materials resource efficiency at the design stage is commonly referred to as 'Designing out Waste'. In accordance with the requirements of the Directive on Waste[iii], the Waste Hierarchy shall be applied in priority order to recommendations regarding material procurement, management of site won materials and waste generation, treatment and disposal associated with the Proposed Scheme. The Waste Hierarchy specifies the following priority order for materials and waste management:

- Prevention;
- Preparing for re-use;
- Recycling;
- Other recovery, e.g. energy recovery; and
- Disposal.

18.1.9. This chapter also describes the significance of the residual impacts that remain post mitigation. In accordance with HD212/11[ii], the assessment excludes any impacts

associated with the transport of materials to, from and within the Proposed Scheme but does consider impacts incurred during up to the end of the manufacturing process.

18.1.10. Operational impacts associated with resource use and waste generation are considered not to be significant in the context of the Proposed Scheme, and would be similar to the operational and maintenance regime of the existing A9. Based on the same reasoning, the operational (maintenance) impacts associated with resource use and waste generation of the Proposed Scheme have been scoped out of this DMRB Stage 3 detailed assessment.

Study Area

18.1.11. The extents of the Proposed Scheme (as defined in Chapter 5: The Proposed Scheme) have been used as a primary study area for the identification of wastes produced and materials resources that will be required.

18.1.12. A secondary study area of 100km has been used for the waste assessment and the material resources assessment. This distance is considered appropriate based on the proximity of the nearest local waste management and mineral resource facilities and the anticipated total quantities of materials required for the construction of the Proposed Scheme whilst limiting the requirement for the transportation of waste and resources over excessive distances.

18.1.13. Distances have been measured in relation to the road network within the study area rather than by using a linear distance. This approach was considered to be more appropriate given the requirement for transportation of materials.

18.1.14. For the assessment of impact on materials resources derived from primary sources, the 100km study area is contained within the boundaries of the Highland and Moray, and TAYplan Aggregates Survey[xxvi] areas. As the available information relates to only the entire aggregate survey areas, it is not possible to characterise the baseline using a radial distance from the Proposed Scheme and therefore the entire Highland and Moray, and TAYplan aggregates survey areas have been used.

18.2. Approach and Methods

18.2.1. Highways England is currently updating Volume 11 (Environmental Assessment) of the Design Manual for Roads and Bridges (DMRB) although as no new guidance has been formally issued the HD212/11 is considered appropriate for informing the assessment methodology.

18.2.2. The Aims and Objectives of Environmental Assessment (DMRB, Vol.11, Part1: HA 200/08)[i] identifies in Table 1.1 the Environmental Impact Assessment topics that should be considered for assessment. One of the topics identified here is Materials and draft guidance has been published for this topic within DMRB Volume 11 – Environmental Assessment – Section 3, Part 6 (HD212/11)[ii]. In the absence of other published guidance this has formed the basis of the assessment.

18.2.3. HD212/11 identifies two levels of assessment that may be undertaken: a simple and a detailed assessment.

18.2.4. Section 4.40 of HD212/11[ii] states that a:

- ‘detailed assessment should be applied where there is the potential for the use and consumption of materials and the production and management of waste to cause significant environmental impacts and where the extent of these can be quantified after the simple assessment’.

18.2.5. A detailed assessment has therefore been undertaken as part of the Stage 3 assessment given:

- The simple assessment carried out at Stage 2 identified the potential for significant environmental impacts;
- The level of detail available for the Proposed Scheme; and,
- The availability of Transport Scotland's Carbon Management System[xxv] (CMS) to quantify embodied carbon emissions.

18.2.6. Impacts will be summarised in Section 18.4 and included in the Detailed Assessment Reporting Matrix as per HD212/11[ii]. The proposed construction stages that will be considered are as follows:

- Site clearance / remediation / preparation;
- Demolition;
- Offline construction, including structures and accesses; and
- Online construction.

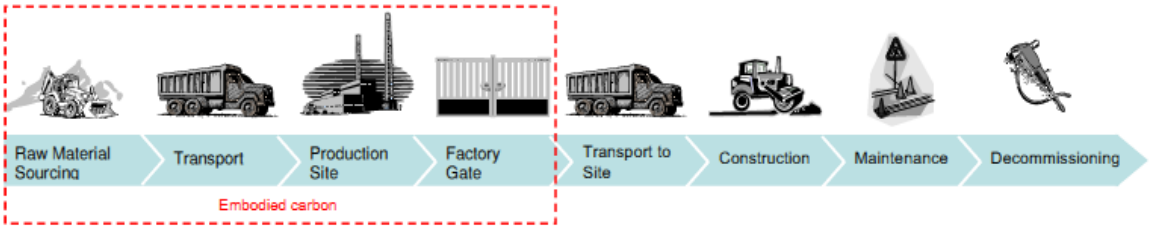
Materials Resource

18.2.7. HD212/11[ii] advocates the use of carbon equivalents as a proxy that can provide a measurement of the environmental impacts from materials resources. Based on this, the consumption of materials resources has been assessed using published data to assign embodied carbon dioxide equivalents (CO_2e) per unit of material used (i.e. tonnes of CO_2 per tonne, or per cubic metric (or similar) of material used).

18.2.8. HD212/11[ii] defines the embodied CO_2 emissions of a material as the total CO_2e released prior to it leaving the factory gate. In this context 'Carbon' is used as short hand to refer to the basket of six greenhouse gases (GHGs) recognised by the Kyoto Protocol.

18.2.9. According to HD212/11 the 'cradle-to-gate' boundary normally includes CO_2 emissions from extraction (or harvesting), the manufacturing process and any pre-distribution transportation (refer to illustration 18.1 below).

Illustration 18.1: Diagrammatic Representation of the Measures of Embodied Carbon in Relation to Material Life Cycle (Highways Agency et al, 2011)



18.2.10. As can be seen by Illustration 18.1, the embodied carbon in materials assessment boundary does not include the CO_2 emissions associated with transport from the factory gate to site, construction activities (i.e. plant fuel use emissions), maintenance or decommissioning of the Proposed Scheme.

18.2.11. An assessment of the potential embodied carbon impacts associated with the material resource demands of the Proposed Scheme has been undertaken using Transport Scotland's CMS[xxv] tool, in line with the requirement of HD212/11[ii] detailed assessment. Total embodied carbon has been estimated, based on the indicative consumption of materials associated with design quantities for the Proposed Scheme. Further details on the use of the CMS tool are provided in Assessment of Impacts.

18.2.12. The CMS tool only focusses on the impact from embodied carbon within the utilised materials. A separate assessment of the impact from the depletion of natural resources from primary resource demand of the Proposed Scheme has also been undertaken

using published information as a basis for this assessment and further information on this is provided later in this chapter in Assessment of Impacts.

Waste Arising from the Proposed Scheme

18.2.13. In addition to assessing the likely impacts from resources that will be used within the Proposed Scheme, this chapter also aims to identify and quantify wastes that are anticipated from the construction of the Proposed Scheme and the potential impact on waste receptors i.e. relevant waste facilities with the study area identified using freely available information.

Legislation and Policy

18.2.14. The following legislation, guidance, key policies and strategies relevant in Scotland seek to influence a sustainable approach to the use of material resources and waste management. These shall be utilised during the detailed design and include but are not limited to:

- Directive on Waste (2008/98/EC)[iii];
- Climate Change (Scotland) Act, 2009[iv];
- Environmental Protection Act 1990, Part II[v];
- The Scottish Government, Scottish Planning Policy, 2014[vi];
- The Scottish Government, Zero Waste Plan, 2010[vii];
- The Scottish Government, Zero Waste Regulations, 2012[viii];
- The Scottish Government, Low Carbon Scotland: Meeting the Emissions Reduction Targets 2013-2027[ix];
- The Scottish Government, Making Things Last: A Circular Economy Strategy for Scotland, 2016[x],
- The Scottish Executive, Choosing Our Future: Scotland's Sustainable Development Strategy, 2005[xi],
- Scottish Government. Scottish Planning Policy, 2014[xii]
- The Waste (Scotland) Regulations, 2012[xiii];
- SEPA's Land Remediation and Waste Management Guidelines, 2009[xiv];
- SEPA's Promoting the sustainable reuse of greenfield soils in construction, 2010[xv];
- SEPA's Guidance on the Production of Fully Recovered Asphalt Road Planings[xvi]; and
- SEPA's Guidance on Recycled Aggregates from Inert Waste[xvii].
- SEPA's Guidance on The Assessment of Peat Volumes, Reuse of Excavated Peat and The Minimisation of Waste, 2012[xviii].
- SEPA. Guidance - Management of Forestry Waste[xix]

18.2.15. The overarching aim of these policy documents is to embed the waste hierarchy into all activities concerning the management of materials and waste across society.

18.2.16. Transport Scotland's Corporate Plan 2017 to 2020 states that Transport Scotland will *"...ensure resources are used effectively"*[xx].

18.2.17. The A9 Dualling Sustainability Strategy[xxi] states that a sustainability objective of the project is "optimising resource efficiency across the life of the A9 Dualling Programme, with particular regard to geographical scale and project alignment".

18.2.18. The A9 Dualling Programme Strategic Environmental Assessment (SEA) Environmental Report[xxii] provides information regarding the resource efficiency requirements for earthworks, construction materials and waste. Within this document Transport Scotland has made a commitment to embed resource efficiency into their construction practices. This commitment has influenced the recommendations made in this chapter and as detailed in Sections 18.5 and 18.6.

18.2.19. The priority of Scotland's Zero Waste Plan[vii] is to treat resources as high up the waste hierarchy as possible by preventing, reusing or recycling resources wherever feasible and to achieve the best overall environmental outcome and the project is also committed to this objective.

18.2.20. The Zero Waste Plan states that 'the Scottish Government will aim to secure 70% recycling of construction and demolition waste by 2020 to contribute to achievement of the UK target'.

18.2.21. The Scottish circular economy strategy[ix] reiterates aims to recycle and reuse 70% of construction and demolition waste by 2020 by keeping products and materials in a high value use for as long as possible

18.2.22. Scottish Planning Policy[vi], paragraphs 178 to 180 state that waste should be minimised during the construction and operation of new developments through adopting the aims of the Zero Waste Plan and implementing the waste hierarchy.

Baseline Data Collection

Information Sources

18.2.23. SEPA, Waste Facility Data, 2015[xxiii] has been used to inform the waste assessment through identifying waste facilities within the study area and providing information on the capacity and acceptable waste types at each facility.

18.2.24. A Stage 2 Ground Investigation programme was carried out between February 2017 and April 2017 for thirteen weeks duration to provide information for the design and construction of the proposed works, including preliminary assessment of geochemical and geotechnical properties of the underlying ground along the route. Findings from the ground investigation have been used to provide an indication of existing ground conditions and to calculate the quantities of certain site won materials.

18.2.25. Chemical testing of the underlying deposits within the Proposed Scheme was undertaken as part of the Stage 2 Ground Investigation and assessment of these results has been completed within Chapter 10: Geology, Soils and Groundwater. A soil and peat management plan has also been produced, as part of Chapter 10, and relevant information has been used within the production of the materials chapter.

18.2.26. A Stage 3 Ground Investigation has recently been partially completed; however, the related information is not currently available and therefore this phase of investigation has not been considered within this chapter.

Consultation

18.2.27. Consultation has been undertaken by Transport Scotland as part of the A9 Dualling SEA process[xxii]. One of the key outputs of the SEA was the development of a range of Strategic Environmental Design Principles in collaboration with consultation authorities, including SEPA. The Principles of relevance to the materials assessment relate to the following aspects:

- Designs to be developed to minimise land take
- Maximise the use of existing route infrastructure where appropriate
- Minimise waste generation through re-use of excavated materials

18.2.28. The above consultation feedback and Design Principles have been considered in identifying preliminary mitigation as detailed later in Section 18.5.

Assessment of Impacts

18.2.29. In line with HD212/11, a detailed assessment of impacts is proposed as there is the potential for the use of materials and production / management of waste to cause significant environmental impacts.

Materials Resource Assessment

Depletion of Natural Resources

18.2.30. Given the potential demand that will be placed on facilities within the study area from the requirement to satisfy the material demand of the Proposed Scheme, an assessment of the predicted use of natural materials from primary sources has been undertaken. This generally refers to the depletion of non-renewable mineral resources (i.e. crushed rock, and sand and gravel).

18.2.31. Impacts to natural resources from the use of these materials within manufactured products needed for the Proposed Scheme have not been assessed as such impacts will not be directly from the Proposed Scheme and there is limited information to allow this to be quantified. Impacts to natural resources from soils and aggregate derived from secondary sources used within the Proposed Scheme cannot be quantified for the same reason.

18.2.32. The assessment has initially assessed a worst-case scenario where all aggregates will be derived from primary sources, although it is likely that site-derived aggregates and aggregates from other secondary / recycled sources shall also be available for use and this scenario has also been considered.

18.2.33. Relevant materials resource data from the TAYplan and Highland & Moray Scottish Aggregates Survey areas has been used within the materials resource assessment. These survey areas provide a strategic approach to planning and development within the Perth & Kinross, Highland Council and Moray Mineral Planning Areas (MPAs) with these including information on resource management. Given their location within the study area these MPAs are considered to represent the most likely primary sources of imported aggregates for the Proposed Scheme. This information is presented within the Scottish Aggregate Survey 2012[xxvi] and this document has been used as the source of this information.

18.2.34. The assessment of impact from the depletion of natural resources has been undertaken by using the available design information to estimate the quantity of the main aggregate-using products that will be used for the construction of the road elements including sub-base, base course, binder course, regulating course, surface course and capping material.

Embodied Carbon Emissions

18.2.35. Transport Scotland has developed the Scotland's CMS Project Carbon Tool[xxv] to measure carbon emissions associated with their construction activities across their road and rail schemes. The CMS is intended to provide a robust and reliable means of measuring, monitoring and reporting a project's carbon footprint across its life cycle. The DMRB Stage 3 design material quantities required for the Proposed Scheme were entered into the CMS to allow CO_2e for of each of the proposed materials to be calculated.

18.2.36. The CMS uses an 'activity' based system to categorise emissions based on the activity that is the source of the emissions, and includes: material use, transport of materials and wastes, plant fuel combustion and electricity consumption, waste treatment, construction site utilities and operational electricity consumption.

18.2.37. The CMS also enables broad estimates on material resourcing requirements (i.e. users can apply local / regional / national transport distance assumptions to each material); however, whilst such broad transportation assumptions may support wider sustainability reporting, they are not required by HD212/11[ii].

18.2.38. Construction elements were identified using Volume 1 of the Manual of Contract Documents for Highway Works (MCHW) - Specification for Highway Works (SHW)[xxiv]. This guidance contains the material specifications required in all components of the construction, improvement or maintenance of the Trunk Road network.

18.2.39. Given that material consumption requirements may differ between design assessment and construction stages, an additional 15% uplift has been applied to the principal material demands and materials resource quantities have been specified as a range of values to account for this. This uplift aims to account for additional materials not covered in this design stage assessment and to allow for additional factors such as the consideration of additional ground investigation information which might influence the anticipated volumes of unsuitable soil material.

18.2.40. The CMS[xxv] has the functionality to assess CO_2e associated with transport of materials to site, transport on-site and maintenance; however, the sourcing locations of materials will not be established until the construction phase and will be based on the approved construction proposals of the appointed contractor(s) and therefore transportation details currently cannot be accurately defined. Therefore, embodied carbon associated with transportation of materials to site has not been included within this assessment and this approach is in accordance with HD212/11[ii] which excludes these elements.

18.2.41. Plant emissions are also excluded at this stage due to the lack of data and the complexity in modelling this fuel / electricity consumption.

18.2.42. Waste emissions are excluded at this stage as the impacts associated with management of waste are assessed based on the capacity for any waste arisings from the Proposed Scheme; it is also likely that the environmental effects associated with waste management would have been dealt with through the facilities own consents.

18.2.43. Reporting via the CMS is intended to be used throughout the design process with more detailed materials, waste, fuel use for plant and transportation data being used as it becomes available at each project delivery stage, enabling wider carbon and sustainability performance reporting. It is anticipated that the construction stage carbon footprint will be further developed and monitored through the construction stage process as more information becomes available

Waste Assessment

18.2.44. The waste assessment identifies and estimates the likely waste arisings from the Proposed Scheme for the construction stages.

18.2.45. The assessment also considers the potential for on-site / off-site re-use of site won materials. These figures are derived from the cut and fill balance calculated for the Proposed Scheme. All material that did not qualify for re-use on site by virtue of the type of material or there being no capacity within the design for re-use was recorded.

18.2.46. Within this chapter, reference to 'unsuitable' soil material relates to U1A, U1B and U2 materials which would require treatment to render them to be a usable resource within a road scheme. These definitions are provided within Volume 1 Specification for Highway Works of the Manual for Contract Documents for Highway Works (MCHW)[xxiv] and relate to the specification which will govern the scheme earthworks. Within the MCHW

guidance, U1A is defined as material that does not meet the requirements of Table 6/1 or Appendix 6/1 of a Series 600 earthworks specification. U1A materials generally relate to materials considered to be geotechnically unsuitable for use and, for example, this includes peat-containing soil materials. The term U1B relates to materials that do not meet the Appendix 6.14 and 6.15 limiting criteria provided within the Series 600 Specification and generally this relates to contaminated materials. Lastly, U2 materials are those that are considered to be hazardous materials or radioactive waste.

18.2.47. It is expected that most waste generated on-site would be Construction and Demolition (C & D) waste. Therefore, the assessment has considered waste facilities within the Highland Local Authority area that may have the capacity to process or dispose of C & D waste.

18.2.48. The type and number of each type of waste facility within the Highland area was identified from SEPA Waste Data[xxiii].

18.2.49. Local capacity has been reassessed for this report based on current data to ensure that the Stage 2 information is still relevant to the Stage 3 assessment.

Impact Assessment Criteria

18.2.50. For all materials and waste impacts, the nature of each impact is classified as being:

- Adverse – Detrimental or negative impact to an environmental resource or receptor; or
- Beneficial – Advantageous or positive impact to an environmental resource or receptor.

18.2.51. Impacts are also described as indirect or direct, and temporary (short-term or long-term) or permanent.

Value/Sensitivity

Depletion of Natural Resources

18.2.52. The assessment of the scale and significance of the potential impacts related to the depletion of primary resources has been based on a combination of the predicted quantities of mineral resources to be used in the Proposed Scheme, and the impacts that this predicted consumption will have on available mineral resources.

18.2.53. As such, the assessment is based on the relative quantities of primary aggregates that will be used and the sensitivity of regional mineral resources.

18.2.54. The sensitivity of the regional reserves of primary materials (crushed rock, and sand and gravel) has been determined using the criteria presented in Table 18.1 below with this adapted from the waste assessment methodology provided in HD212/11 which is considered appropriate for this purpose.

Table 18.1: Sensitivity of Regional Reserves in relation to Materials Resource Requirements derived from Primary Sources

Sensitivity	Description
Very High	There are no supplies of mineral resources within the study area
High	There are limited supplies of mineral resources within the study area
Medium	There are adequate supplies of mineral resources within the study area
Low	There are good supplies of mineral resources within the study area

Embodied Carbon Emissions

18.2.55. With regard to material resource, paragraph 4.42 of HD212/11 details how the magnitude of impact and the scale of the magnitude of impact can be calculated without regard to the value / sensitivity of a receptor / resource. As detailed in HD212/11, significance of impact with regards to material resource cannot be calculated and the detailed assessment considers the magnitude of the impact only.

Waste Assessment

18.2.56. With regard to waste, the sensitivity of the waste capacity and therefore sensitive receptors within the study area is determined by using the following criteria provided in Table 18.2:

Table 18.2: Sensitivity of Receptor(s) - Waste

Sensitivity	Description
Very High	There is no available waste management capacity for any waste arising from the project
High	There is limited waste management capacity in relation to the forecast waste arising from the project
Medium	There is adequate waste management capacity for the majority of wastes arising from the project
Low	There is adequate available waste management capacity for all wastes arising from the project

Magnitude of Impact

Depletion of Natural Resources

18.2.57. The magnitude of the impact related to the depletion of primary resources has been assessed against the scale provided in Table 18.3 below which has been adapted from HD212/11. This application of the level of magnitude was based on professional judgement.

Table 18.3: Magnitude of Impact – Depletion of Regional Primary Resource Reserves

Magnitude	Description
Major	Considerable impact (by quantity) of more than local significance in relation to the use of mineral resources
Moderate	Moderate impact (by quantity) of more than local significance in relation to the use of mineral resources
Minor	Slight impact (by quantity) of more than local significance in relation to the use of mineral resources
Negligible	Negligible impact (by quantity) of more than local significance in relation to the use of mineral resources.

Embodied Carbon Emissions

18.2.58. The embodied carbon emissions are considered a proxy measure of the environmental impacts of materials according to the scale of impact magnitude summarised in Table 18.4, as per HD212/11[ii].

Table 18.4: Scale of Impact Magnitude – Material Resource

Magnitude	Total CO_2e of Materials (tonnes)
Major	>40,000
Moderate	20,000 – 40,000
Minor	5,000 – 20,000
Negligible	1,000 – 5,000
No change	<1,000

Waste Assessment

18.2.59. The magnitude of impact for waste is ranked according to scale in accordance with HD212/11, and is summarised in Table 18.5 below.

Table 18.5: Magnitude of Impact - Waste

Magnitude	Description
Major	Wastes are predominantly disposed of to landfill or to incineration without energy recovery with little or no prior segregation
Moderate	Wastes are predominantly disposed of to incineration with energy recovery
Minor	Wastes are predominantly segregated and sent for composting, recycling or further segregation and sorting at a material recovery facility
Negligible	Wastes are predominantly reused on site or at an appropriately licensed or registered exempt site elsewhere

Impact Significance

Embodied Carbon Emissions

18.2.60. The guidance provided within HD212/11 does not provide a methodology for the estimation of the significance of impacts from embodied carbon emissions. As outlined above, the scale of magnitude of these impacts gives an estimation of the severity of the identified impacts. Only the scale of magnitude has been used to quantify the impact from embodied carbon emissions.

Depletion of Natural Resources and Waste Assessment

18.2.61. In line with HD212/11, the assessment of significance in relation to waste is based on the magnitude of the impact and the sensitivity of the receptor. The assessment methodology is also considered to be applicable to the assessment of impact from the depletion of natural resources and has therefore also been used for this purpose. By establishing the sensitivity / value of the receptor and the magnitude / nature of the impact the significance of the associated impact can be determined using the matrix provided in Table 18.6 below.

Table 18.6: Matrix Detailing the Calculation of Significance for Impacts Relating to Waste and the Depletion of Natural Resources

Magnitude of Impact	Level of Significance Relative to Sensitivity / Value of Receptor			
	Very High	High	Medium	Low
Major	Very Large	Large / Very Large	Moderate / Large	Slight / Moderate

Magnitude of Impact	Level of Significance Relative to Sensitivity / Value of Receptor			
	Very High	High	Medium	Low
Moderate	Large / Very Large	Moderate / Large	Moderate	Slight
Minor	Moderate / Large	Slight / Moderate	Slight	Neutral / Slight
Negligible	Slight	Slight	Neutral / Slight	Neutral

18.2.62. Impacts of Large / Very Large and above are considered to be significant in the context of the EIA Regulations. Mitigation measures to avoid or reduce impacts have been considered and reported later in this chapter in Section 18.5.

Limitations of the Assessment

18.2.63. In relation to the provided materials quantities, the following limitations and assumptions should be noted.

- The quantities are based on the DMRB Stage 3 level of design, with associated embedded mitigation and it is anticipated that these may be revised in the future prior to and during the construction process.
- Indirect impacts on primary resources from manufactured materials and secondary sources obtained off site have not been considered within the assessment as insufficient information is available to allow these impacts to be calculated accurately.
- The volumes of unsuitable soil material discussed within this chapter are based purely on geotechnically unsuitable materials. Insufficient chemical testing information is currently available for the Proposed Scheme to allow geochemically unsuitable materials to be estimated and therefore these have not been considered within the assessment. The Stage 3 Ground Investigation has recently been partially completed for the Proposed Scheme; however, information from this investigation is currently unavailable. The quantity of geochemically unsuitable soils is anticipated to be small compared to that of geotechnically unsuitable soils.
- All site won topsoil and peat shall be suitable for use within proposed landscaping areas depending on demand (see Appendix 10.3). All site won rock and concrete shall also be suitable to be used to meet the Proposed Scheme's aggregate demand after processing.
- For the materials assessment it is assumed that approximately a third of aggregate material required for sub base and capping will be sourced from primary resources outwith the Proposed Scheme. This has been based on a comparison of the volume of anticipated rock and concrete arisings from the Proposed Scheme (235,466m^3) and the aggregate requirement for capping and sub base (352,236m^3) and assuming that all site won material can be reused.
- A 15% uplift has been applied to the anticipated materials quantities. This is considered sufficient to account for any uncertainty and to accommodate future revisions to these quantities.
- All provided information is understood to be factually correct based on the available design information at the time of writing. No attempt has been made to verify information provided by third parties.

18.2.64. Volumes of unsuitable soils will be further informed by the Stage 3 Ground Investigation which has recently been partially completed although the related information was not available at the time of writing and is therefore not available for inclusion in the Environmental Statement.

18.2.65. The following represents a list of assumptions and considerations that were made within the materials assessment with regards to use of the CMS tool[xxv].

- Civil engineering structures: includes precast and in situ concrete, formwork, stonework, rebar and steelwork associated with proposed structures, retaining walls and culverts.
- Road pavement: includes surface course, base course, binder course, sub-base and kerbs associated with the proposed main alignment, junctions, access tracks and cycle paths.
- Safety barrier: includes vehicle restraint system (VRS).
- Drainage: is anticipated to include filter and carrier drains, headwalls, manholes, gully gratings and frames.
- In relation to the information inputted into the CMS tool[xxv], due to the scale and geographical extent of the earthworks associated with the Proposed Scheme, site-won soil and topsoil have been specified as 'imported soil/general fill' and site-won aggregates have been specified as 'recycled aggregates'. These specifications are used as a proxy to account for the emissions associated with the excavation and processing of the materials on-site.
- The embodied carbon emissions of site-won materials are specified as zero within the CMS[xxv] in terms of materials use. Emissions for site-won materials are captured within the CMS under the plant fuel consumption activity, details of which will be completed during the construction phase. As a result, specifying the materials as site-won underestimates the embodied carbon of the material resources for the Proposed Scheme.

18.3. Baseline Conditions

18.3.1. An estimate of the quantity of materials and waste was derived from the Stage 3 design of the Proposed Scheme as follows.

Material Resource

18.3.2. The operation of the existing A9 between Dalraddy and Slochd does not require any substantial material resource and does not generate large quantities of waste during 'normal' maintenance activities on the road. Moreover, there is no available data to determine a quantitative baseline for this section of the existing A9.

18.3.3. There is potential for a proportion of the materials required for the Proposed Scheme to be located and resourced within the study area. This is of relevance to the use of primary raw materials e.g. virgin soils and aggregates from quarries. The impact on such receptors has been fully assessed within the Loss of Mineral Deposits, Soils and Peat section within Chapter 10: Geology, Soils and Groundwater.

18.3.4. There is also a potential for a raw materials surplus to be created during the construction of the nearby sections of the A9 Dualling project and as such there is a possibility that these materials can be used within the Proposed Scheme. The quantity of such materials is not known at present.

Depletion of Natural Resources

18.3.5. Primary aggregates are materials extracted directly from the ground and are defined by the British Geological Survey (BGS) as 'aggregates produced from naturally occurring mineral deposits, extracted specially for use as aggregates and used for the first time'.

18.3.6. Scottish Planning Policy[vi] outlines a landbank approach to planning the supply of 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 10-year period, based on current production levels.

18.3.7. The Scottish Aggregates Survey Report for 2012[xxvi] highlights that the most important primary aggregate sources in Scotland are crushed rock, and sand and gravel. An estimate of aggregate production in 2012 is recorded within this document and pertinent information is provided in Table 18.7 below.

18.3.8. The Highland and Moray, and TAYplan Aggregates Survey areas are located within the study area and are therefore relevant to the Proposed Scheme. The Scottish Aggregates Survey Report confirms the amount of aggregates produced during 2012 and the available landbank at the end of 2012 for these survey areas. Table 18.7 below summarises this data which has been taken from The Scottish Aggregates Survey Report.

Table 18.7: Primary Aggregate Production in Highland & Moray and TAYplan Survey Areas

Regions	Hard Rock		Sand & Gravel	
	Primary Aggregate Production (tonnes)	Maximum Supply from Active Sites at 2012 Production Levels (years)	Primary Aggregate Production (tonnes)	Maximum Supply from Active Sites at 2012 Production Levels (years)
Highland & Moray	6,040,000	4	521,000	10
TAYplan	848,000	20	827,000	13

18.3.9. The BGS Directory of Mines and Quarries 2014[xxvii] which provides a list of active quarries and mines across the UK highlights that there are a number of mines and quarries located within the study area that are able to supply a wide variety of materials.

18.3.10. Potential sources of primary aggregates within the study area include Granish Quarry located approximately 160 m from the Proposed Scheme, Mid Lairgs Quarry at Daviot, approximately 20 km from the Proposed Scheme and Craigellachie Quarry approximately 50 km from the Proposed Scheme.

18.3.11. The baseline data indicates that there is a substantial landbank of crushed rock and sand and gravel at the time of the assessment. As such, the study area is considered to have a low sensitivity with regards to the depletion of natural resources.

Waste

18.3.12. The local waste infrastructure and the potential waste management capacity have been identified using SEPA waste data for 2015[xxiii]. This is the most recent information that is currently available.

Construction and Demolition Waste

18.3.13. This assessment defined Construction and Demolition waste as waste materials arising from UK commercial C and D sites. This type of waste comprises, but is not limited to:

- Off-cuts and waste timber;
- Plastics (such as uPVC and HDPE);
- Glass (such as windows);
- Packaging waste materials (such as card, wood and plastic film);
- Inert materials (such as soil); and
- Aggregate materials (such as masonry, brick, block paving, tiles and ceramics) and plasterboard in mixed waste.

18.3.14. In addition, the following represent additional waste materials associated with the Proposed Scheme that are anticipated:

- existing VRS, signage, fencing, kerbing and existing pavement material to be removed during the construction works;
- demolition of structures and redundant buildings;
- disposal of unsuitable soil materials; and
- disposal of excess suitable soils and rock materials.

18.3.15. SEPA produces data sheets, the latest in 2015[xxviii], which indicate the quantities of business waste, which includes C and D waste, produced and treated in each Local Authority area. The total quantity of business waste managed in the Highland area[xxviii] is summarised in Table 18.8. Similar information relating to only C&D waste is not available.

Table 18.8: Quantity Business Waste Treated in the Highland Area in 2015

Waste Type	Amount (Tonnes)
Soils	4,358
Metals	3,115
Mineral Waste	2,029
Wood	1,199

Waste Management Facilities

18.3.16. SEPA 2015 Waste Facility Data[xxiii] was accessed to allow for the identification of waste facilities near the site and the most appropriate facilities are detailed in Tables 18.9 and 18.10. The different facilities available for managing the C and D waste within 100km of the Proposed Scheme comprise the following:

- Landfill Sites;
- Waste Transfer Stations;
- Metal Recyclers; and,
- Multiple Activity Sites.

18.3.17. Waste management facilities within the study area with an annual capacity of less than 5000 tonnes or that are unlikely to accept waste from the Proposed Scheme, i.e. only accept household waste or are solely civic amenities, have been omitted from Table 18.9 as have non-operational sites i.e. waste facilities that were accepting no waste at the time the data was collated by SEPA.

18.3.18. In relation to reference to special waste within Table 18.9, this is also classed as hazardous waste in SEPA guidance document WM3[xxix]. Confirmatory testing will need to be carried out on all soils to be disposed of off-site to determine the appropriate waste management option.

Table 18.9: Sensitivity Rating for Waste Facilities

Name	Approximate Distance from Proposed Scheme	Type	Annual Capacity (Tonnes)	Remaining capacity (Tonnes) (end 2015)	Sensitivity	Comments
David Ritchie and Sons Ltd, Aviemore. Granish Recycling Centre / Transfer Station	<1km	Recycling Centre / Waste Transfer Station	25,000	N/A*	Medium to High	Available capacity for metal recycling
Granish Landfill Site Cell 3, By Aviemore	<1km	Landfill / Civic Amenity	26,000	70,000	High	Limited waste capacity
R Finnie Skip Hire, 32 Longman Dr, Inverness	30km	Metal Recycler / Transfer Station	10,000	N/A*	Medium to High	Accepts hazardous waste (special waste)
Inverness WWTP, Allanfearn, Inverness	30 km	Transfer station / Other treatment	73,000	N/A*	Medium to High	Waste type not specified although SEPA has indicated that this facility does not accept soils.
Pat Munro, TS, Lotland St, Inverness	30 km	Transfer station	20,200	N/A*	High	No comment
SITA UK, Stoneyhill WTS, Henderson Drive, Inverness	30km	Waste Transfer Station	150,000	N/A*	High	Accepts special asbestos waste
John Lawrie (Aberdeen) Ltd, Metal RC, Evanton	60km	Metal recycler / Transfer station	24,999	N/A*	Medium / High	No comment
Wm Munro Construction, Composting ABP & TS, Evanton Ind. Est., Evanton	60km	Transfer station / Composting	50,000	N/A*	High	No comment
Pat Munro TS, Caplich Quarry, Alness	60km	Transfer station	24,999	N/A*	High	No comments
MSIS, Admiralty Base, Shore Road, Invergordon	65km	Other treatment	10,000	N/A*	High	Treated waste type not specified. Sensitivity assumes

Name	Approximate Distance from Proposed Scheme	Type	Annual Capacity (Tonnes)	Remaining capacity (Tonnes) (end 2015)	Sensitivity	Comments
						acceptance of soils (worst case)
Forres CA/TS, Waterford Road, Forres	70km	Civic amenity / Transfer station	15,288	N/A*	High	No comments
D & S Metals MR, Greshop Ind. Est., Forres	70km	Metal recycler	22,260	N/A*	Medium	No comments
Douglas J Williamson, Moycroft Industrial Estate, Elgin	90km	Metal recycler / Transfer station	75,000	N/A*	Medium / High	Accepts special waste
Moycroft Civic Amenity & TS, Elgin	90km	Civic amenity / Transfer station	59,999	N/A*	High	Accepts special waste
Nether Dallachy Landfill Site	90km	Landfill	120,000	145,000	High	No comments
Grays Recyc Serv TS,Nether Dallachy,Fochabers	90km	Transfer station / Composting	20,800	N/A*	High	No comments
Ley Farm Composting Facility, Fordyce, Portsoy, AB45 2XS	95km	Composting	12,500	N/A*	High	Accepted waste type not specified.

*This data is not available from SEPA

A planning application is currently being considered for a new waste management facility in Daviot. This facility will be able to reprocess excavated materials and produce recycled aggregate although further details regarding the likely capacity of this facility are not known at present.

Table 18.10: Total Waste Capacity by Waste Facility Type

Waste Facility Type	Total annual capacity (tonnes)
Landfill	146,000
Recycling Centre / Transfer Station	270,486
Recycling Centre / Transfer Station (accepts metal waste)	157,259
Transfer Station / Other Treatment / Composting	166,300

18.3.19. Tables 18.9 and 18.10 detail relevant potential waste sites within the study area to provide a context for the processing of waste arising from any Proposed Scheme. This information has been taken from SEPA 2015 Waste Facility Data[xxiii].

18.3.20. Information pertaining to remaining capacity within the majority of the waste facilities was not available from SEPA and in these cases the sensitivity has been calculated based on the annual capacity.

18.3.21. Table 18.9 indicates that there are five facilities that can accept metal waste from the Proposed Scheme. As relatively small quantities of metal are anticipated it is likely that any one of these facilities could process the metal waste arising from the scheme.

18.3.22. With regards to potential soil and aggregate quantities, the facilities located within the study area are all considered to have a high sensitivity to materials from the scheme that may need to be processed. This is due to the relatively high quantities of these materials that are anticipated as a result of the construction works compared to the available capacity within facilities in the study area.

18.3.23. It is assumed that a large quantity of soil and rock material would be classed as 'inert' by the receiving facilities and there was found to be a shortage of facilities able to process this type of waste within the study area. Disposal of excess inert materials that cannot be reused will currently require consideration of waste facilities located more than 100km from the Proposed Scheme. The nearest landfill accepting inert waste is located approximately 150km from the Proposed Scheme at Park Quarry near Aberdeen. This facility has an annual capacity of 75,000 tonnes. It is also known that a planning application is currently being considered for a new waste management facility in Daviot and that this facility will have the ability to process inert waste.

18.3.24. The assessed information indicated that there are a number of facilities in the study area with the potential to process special waste indicating that disposal of these materials may be less challenging than the disposal of inert soil material. The establishment of a waste management facility that has the potential to process inert waste may also represent a means of processing excess materials arising from the Proposed Scheme, although re-use options should be exhausted prior to adopting a disposal option for any excess soil / rock etc. SEPA guidance documents A Guide to Waste Management Licensing[xxx]; and, Land Remediation and Waste Management Guidelines[xxxi], should be referred to for further information.

18.3.25. It is anticipated that there will be opportunity for on-site and off-site re-use of site arisings and this will limit the requirement for reliance on off-site waste management facilities. This is discussed further in Sections 18.4 to 18.6.

18.4. Potential Impacts

18.4.1. The potential impacts of the Proposed Scheme from materials and waste are detailed in this section.

18.4.2. The assessment has been based on relevant information from DMRB Stage 3 where this information was available.

18.4.3. Carbon dioxide levels in the atmosphere have increased significantly. Upland peat areas are considered to be a significant carbon store. Peat can sequester atmospheric CO_2 in perpetuity if the peat is in good condition. Waterlogged soils promote anaerobic conditions which prevents the decay of vegetation and subsequent release of carbon. Well managed upland soils / peat can assist in counteracting rising CO_2 levels by storing carbon as well as sequestering more CO_2 from the atmosphere. As such, it is desirable to minimise peat loss in terms of carbon emissions / climate change.

18.4.4. With regard to peat / peaty soils, mitigation has included avoidance by design. Where possible, areas of deep peat and priority peatland habitats have been actively avoided but there are areas of the scheme which will require the presence of peat deposits to be considered within the design.

18.4.5. A Soil and Peat Management Plan (Appendix 10.3) discusses the intentions for peat arisings at the Proposed Scheme. Whilst there is considerable potential for re-use of peat within the Proposed Scheme there is also potential for off-site reuse in preference to disposal. Note that the Soil and Peat Management Plan only considers the anticipated quantities of topsoil and peat does not consider other surplus soils that will be derived from the earthworks for the Proposed Scheme.

Construction Phase Impacts

Depletion of Natural Resources

18.4.6. An estimate of the predicted mineral resource requirement for the construction of the Proposed Scheme has been calculated through a review of the main aggregate using materials that will be required including resources such as capping, sub-base, base course, regulating course and binder course.

18.4.7. Table 18.11 summarises the estimated quantities of mineral resources as a result of the construction of the Proposed Scheme. The quantities detailed in Table 18.11 consider the earthworks cut/fill balance i.e. only soil deficit has been included. Table 18.11 also assumes that all aggregate shall be imported although there will be a potential for reuse of site won rock.

Table 18.11: Estimated Aggregates Consumption Range (including 15% uplift)

Material	Approximate Quantity Range
Imported soil / general fill	628,666t – 722,966t (502,933m^3 – 578,373 m^3)
Sub base and capping material	880,590t – 1,012,679t (352,236m^3 – 405,071m^3)
Aggregates for asphalt (base, binder and surface) course	325,753t – 374,616t (130,301m^3 – 149,846m^3)

18.4.8. For comparative purposes and assuming no reuse of site won materials, the Proposed Scheme's total potential consumption of mineral resources across the entire construction phase is likely to be approximately 22 - 26% of the total primary materials produced in the study area during 2012, based on data contained within the reviewed Aggregate Surveys[xxvi]. Note that the lower percentage includes no uplift and the higher percentage includes a 15% uplift.

18.4.9. A large quantity of rock will be produced during rock cut work at Slochd Summit, Slochd Mor and Slochd Beag and a quantity of concrete will also be produced during site clearance and demolition activities. It is likely that a substantial amount of this material will be suitable for use as aggregate once processed and this will limit the need for primary resources from outwith the Proposed Scheme to be utilised.

18.4.10. The quantity of aggregate material that can potentially be sourced from excess materials created by the Proposed Scheme is 488,665 tonnes (235, 466m^3) and further detail on this quantity is provided in Table 18.13. Assuming that all of this material can be reused to partially meet the aggregate demand of the scheme then the demand on primary resources can be reduced to approximately 16 - 20% of the total primary aggregates produced in the study area during 2012. Note that the lower percentage includes no uplift and the higher percentage includes a 15% uplift.

18.4.11. Based on the methodology provided earlier in this chapter, primary materials resources have been given a low sensitivity and there will be a minor impact on primary resources consumption as a result of the Proposed Scheme. Therefore, the significance of the depletion of natural resources is Neutral / Slight and the nature of the impact is adverse, direct and permanent.

18.4.12. The demand on off-site primary resources can be further reduced through the reuse of excess material from other sections of the A9 Dualling project in preference to these primary resources. Information on surplus materials from these sections is not known at present and therefore the degree to which materials demand can be satisfied by this means cannot be ascertained.

Embodied Carbon Emissions

18.4.13. An estimate of the quantity of materials and waste was derived from the detailed design of the Proposed Scheme based on information available as of April 2018, further details of which can be found in the following chapters and appendices:

- Chapter 5: The Proposed Scheme which outlines the potential materials and construction techniques required to build the Proposed Scheme; and,
- Chapter 10: Geology, Soils and Groundwater which describes the existing ground conditions.
- Appendix 10.3 Soils and Peat Management Plan which discusses the peat constraint at the Proposed Scheme and the approach for managing this.

18.4.14. Table 18.12 below provides a summary of the potential materials required (including a 15% uplift) from the construction of the Proposed Scheme based on the most current DMRB Stage 3 scheme design and estimated quantities. With relation to Table 18.12, the upper quantity limit includes 15% uplift and the lower limit includes no uplift.

18.4.15. The CMS Tool[xvii] was utilised to assess the total embodied carbon emissions associated with the materials anticipated for the Proposed Scheme. The embodied carbon emissions associated with the predicted material resource for the Proposed Scheme are also presented in Table 18.12.

Table 18.12: Estimated Quantity of Materials Required for the Scheme and Estimated Range of Embodied Carbon Emissions (including 15% uplift)

Material Resource	Approximate Range of Material Quantities	Estimated Range of Embodied Carbon Emissions (tCO_2e)
Series 0300: Fencing		
High tensile strained wire deer fence 2.1m high	58,500m – 67,275m	1,410 – 1,621
Series 0400: Road Restraint System		
N2 Single sided steel safety barrier	20,517m – 23,595m	1,452 – 1,669
N2 Double sided steel safety barrier	24,834m – 28,559m	1,312 – 1,509
Series 0500: Drainage		

Material Resource	Approximate Range of Material Quantities	Estimated Range of Embodied Carbon Emissions (tCO_2e)
Carrier drain (concrete pipe) - various internal diameters	8,375 m – 9,631 m	443 - 509
Filter drain – various internal diameters	64,605m – 74,296m	2,520 – 2,898
Precast concrete manhole – Type 3a chamber (1200 dia with 300 dia pipe) with Grade B125 cover	963no – 1,107no	482 - 555
Precast concrete manhole – Type 3b chamber (1500 dia with 450 dia pipe) with Grade B125 cover	106no - 122no	81 - 93
Gully grating and frame – Class D400 to drainage channel, Iron, 300 mm wide	51no – 59no	2.3 – 2.6
Headwalls – Pre-cast concrete Type 3, 600 mm diameter pipe	83no – 95no	121 - 139
Series 0600: Earthworks		
Imported virgin aggregates[1] (for capping)	51,600m^3 – 59,340m^3	1,271 – 1,462
Site-won aggregates[1, 2] (for capping)	103,202m^3 – 118,682m^3	694 - 798
Site-won soil / general fill[3]	1,239,808 – 1,425,779m^3	43,443 – 49,959
Site-won topsoil and peat[3]	351,124m^3 – 403,793m^3	12,303 – 14,148
Series 0700: Pavement & Series 1100: Kerbs, Footways and Paved Areas		
Surface course (TS2010) (30- 40mm thickness)	561,550m^2 – 645,783m^2	3,909 – 4,495
Base course (140-225mm thickness)	540,902m^2 – 622,037m^2	18,285 – 21,028
Binder course (50-60mm thickness)	561,569m^2 – 645,804m^2	5,088 – 5,851
Sub-base – primary aggregates[1]	65,811m^3 – 75,683m^3	1,622 – 1,865
Sub-base – recycled aggregates[1]	131,623m^3 – 151,366m^3	885 – 1,017
Kerbs	11,865m – 13,645m	156 - 180
Series 1200: Traffic Signs		
Road markings	120,390m – 138,449m	165 - 190
Road studs	8,345no – 9,597no	68 - 78
Series 1600: Piling and Embedded Retaining Walls		
In-situ concrete piles	4,931m^3 – 5,671m^3	2,358 – 2,711
Series 1700: Structural Concrete		
Insitu Concrete	28,542m^3 – 32,824m^3	11,620 – 13,363
Precast concrete	3,062m^3 – 3,521m^3	1,462 – 1,681
Recycled steel rebar	2,622t – 3,016t	1,888 – 2,171

[1] Approximately 67% of sub base and capping aggregate requirement can be met through reuse of site won materials. This is based on current estimate of site won aggregate.
[2] As per the assumptions mentioned earlier in the chapter, site-won aggregates have been entered into the CMS Tool as 'recycled aggregates'.
[3] As per the assumptions mentioned earlier in the chapter, site-won peat/topsoil and site-won soil has been entered into the CMS Tool as 'imported topsoil' and 'imported soil / general fill'.

Material Resource	Approximate Range of Material Quantities	Estimated Range of Embodied Carbon Emissions (tCO_2e)
Steelwork	2,948t – 3,390t	4,510 – 5,187
Formwork	38,496t – 44,270t	17,323 – 19,922
Stonework	477m^2 – 548m^2	6.8 – 7.8
Total Embodied Carbon Emissions (tCO_2e)		**134,879 – 155,111**

18.4.16. As shown in Table 18.12, the estimated range of total tCO_2e for the Proposed Scheme is 134,879 to 155,111. Therefore, the impact would be indirect, adverse and permanent with a scale of impact magnitude of major in accordance with the criteria set out in Table 18.4.

Waste Assessment

18.4.17. In line with the waste hierarchy, where excess materials are created during the construction of the Proposed Scheme, all attempts should be made to undertake recovery, recycling or re-use of these materials over their deposition. Materials will only be considered waste where there is no defined use for these.

18.4.18. The main likely waste arisings due to the construction of the Proposed Scheme are indicated in Table 18.13 below. Earthworks are the main component considered to create surplus amounts but substantial quantities of other materials are also anticipated. In some instances, there will be an opportunity to reuse these on or off-site and possible waste management options are discussed in Table 18.13.

Table 18.13: Anticipated Arisings from the Proposed Scheme

Material Resource	Amount	Reuse / Recycling options	Reuse / Recycling quantities	Anticipated waste quantity
Site won topsoil	317,169m^3 (396,461t)	These soils will not be suitable for use as structural fill but there is potential for their reuse in areas of landscaping within the Proposed Scheme or within reuse off-site.	Approximately 351,124m^3 of topsoil / soil is estimated to be required for proposed landscaping and re-soiling of verges and slopes.	Current estimate is that peat (after pre-treatment) and topsoil will be re-used on site and therefore up to approximately 602,999m^3 of site won soils will not be able to be reused on site. There will be a potential that this can be reused off-site although this cannot be estimated or guaranteed at present.
Site won soils – cut/fill balance surplus from bulk earthworks (suitable soils)	602,999m^3 (753,749t)	These are surplus soils and include those unsuitable for use within the Proposed Scheme. These may be suitable for reuse off-site.	Assuming that confirmatory testing shows that soils are suitable for use then all surplus soils can be reused depending on off-site demand.	

Material Resource	Amount	Reuse / Recycling options	Reuse / Recycling quantities	Anticipated waste quantity
Peat (unsuitable soils)	53,020m^3 (42,416t)	These soils will not be suitable for use as structural fill but there is potential for their reuse in areas of landscaping or off-site restoration areas.	Approximately 351,124m^3 of topsoil / soil is estimated to be required for the proposed landscaping and re-soiling of verges and slopes. Site won peat will be suitable for this purpose after some pre-treatment e.g. drying and mixing with non-peat.	
Concrete from demolished structures	600m^3 (1,500t)	There is potential for these materials to be crushed and used as an alternative to primary aggregate needed for pavement requirements.	Up to 482,537m^3 of aggregate is estimated to be required for use within the proposed road pavement and for sub base and capping material. It is estimated that 67% of the required sub base and capping materials can be derived from site won material based on the assumption that all of this material can be reused. Any surplus that cannot be used within road and cycle path construction may have reuse potential in non-structural and structural applications off-site.	Assuming that all material will be suitable for use within sub-base and capping material, there will be no excess material.
Concrete from demolished culverts	1,402 m^3 (3,505t)			
Concrete (redundant kerbing)	2,116m^3 (5,290t)			
Rock cut	200,000m^3 (400,000t)			
Rock Armour (recovered during site clearance)	900m^3 (2,250t)			
Recovered sub base material from existing carriageway	30,448m^3 (76,120t)			
Recovered surfacing from existing carriageway	63,940m^3 (127,880t)	It is estimated that approximately 80% of existing carriageway surfacing will be suitable for reuse either on or off-site. The remainder will have limited use.	Based on the estimated reuse potential, 51,152m^3 of existing carriageway surfacing can be reused.	12,788m^3 (25,576t)

Material Resource	Amount	Reuse / Recycling options	Reuse / Recycling quantities	Anticipated waste quantity
Metals (redundant safety barrier)	400m^3 (3,203t)	As detailed in Table 18.9, there are several facilities in the study area that possess the capacity to process metals produced on-site.	Facilities in the study area have recycling capacity well in excess of the anticipated quantities.	It is anticipated that all metals will be capable of processing in waste facilities in the study area.
Metals from redundant fencing	18.3m^3 (146t)			
Wood from redundant fencing	640m^3 (448t)	There might be some potential for reuse of wooden posts within new fencing either on or off-site. Additional reuse potential may be possible for chipped wood.	The exact quantities of wood and timber that can be reused cannot be estimated at this stage as this will generally relate to ability of off-site activities to accept excess material. It is anticipated that reuse will be possible for the majority of this material.	Exact quantity cannot be estimated given unknown reuse potential although the likely quantity of waste is considered to be relatively trivial compared to other waste streams.
Notes. The following assumptions have been made in calculating the anticipated tonnages: density of soil = 1.25t/m^3; density of peat = 0.8t/m^3; density of rock cut = 2.0t/m^3; density of concrete/other rock = 2.4t/m^3; density of steel = 8.0t/m^3, asphalt = 2.0t/m^3, wood = 0.7t/m^3.				

18.4.19. Table 18.13 indicates that a minimum of approximately 438,877 tonnes of excavated soils and all 488,665 tonnes of site-won rock and concrete would be suitable for reuse as part of the Proposed Scheme. This accounts for approximately 55% of all the expected rock/concrete and soil arisings for the Proposed Scheme. Approximately 753,749 tonnes of excavated soils are likely to be unsuitable for reuse in structural fill although off-site reuse may be possible.

18.4.20. With regards to excess metals and wood, the identified waste facilities would be likely to have sufficient capacity to deal with these materials if these will not be reused. However, the identified waste facilities within the study area are unlikely to have the capacity to treat / handle / dispose of the predicted quantities of excess soils so either off-site reuse or the establishment of a new waste management facility will be required. In line with the waste hierarchy, off-site reuse is the preferred option for excess materials.

18.4.21. In terms of available waste facilities, these were generally classified as high sensitivity due to a lack of waste capacity to deal with some waste streams (i.e. excess soils). Waste facilities registered to process only metallic waste were considered to possess a medium sensitivity due to their current capacity compared to the relatively low quantities forecasted of this type of waste. Assuming the majority of all excess materials cannot be diverted from a disposal option then a major impact is forecast and this will correspond with an impact significance of large to very large. The impact will be adverse and direct.

18.4.22. The available information indicates that approximately 50% (by volume) of all predicted arisings can be reused on-site although this figure may change as additional information

becomes available. This does not consider off-site reuse as this cannot be guaranteed or estimated at present. Assuming there is a potential for off-site reuse, the amount of waste requiring disposal will be reduced. Where there is a potential for off-site reuse and this allows for the majority of materials to be reused either on or off-site then the impact significance will be reduced to slight which corresponds to a negligible impact. The impact will be adverse and direct.

Policy Assessment

18.4.23. An assessment of compliance with key legislation / policy relevant to the Proposed Scheme is provided in Chapter 19 (Policies and Plans).

18.4.24. Table 18.14 provides a summary of the 'impacts' of the Proposed Scheme on the interaction and compliance with legislation and policies relevant to the Materials assessment.

Table 18.14: Compliance of the Scheme with Relevant Policies / Legislation

Legislation / Policy	Description of Interaction	Compliance
Directive on Waste (2008/98/EC)[iii]	The management of waste throughout the project would use the waste hierarchy, prioritise waste prevention and encourage reuse and recovery on site before considering treatment or disposal options. All waste will be managed in such a way as to prevent harm or adverse impacts to sensitive receptors.	Yes
Environmental Protection Act 1990, Part II [v]	The construction Contractor would ensure that excess materials produced during construction would be handled, disposed of or recovered in such a way that harm to the environment is minimised and in line with national waste management protocol.	Yes
Waste (Scotland) Regulations 2012 [xiii]	These regulations have the key aim to limit the amount of waste material being sent to landfill through the adoption of the waste hierarchy. Mitigation measures aim to prevent or to reduce, as far as possible, the negative environmental impacts of landfilling and to ensure that the waste hierarchy is implemented.	Yes
Zero Waste Plan 2010 [vii]/ Zero Waste Regulations 2012 [viii]	The construction Contractor of the Proposed Scheme would ensure that waste materials are treated as high up the waste hierarchy as possible by preventing, reusing or recycling waste whenever feasible and to achieve the best overall environmental outcome. As stated within the Plan, the Scottish Government aims *to secure 70% recycling of construction and demolition waste by 2020 to contribute to achievement of the UK target*.	Yes
Transport Scotland Corporate Plan (2012 – 2015)[xx]	In line with the Corporate Plan the Proposed Scheme utilises the CMS to report the total carbon load so as support Transport Scotland's aim to *influence and support low carbon decision-making across the design and delivery of transport infrastructure projects and network maintenance*. Through implementation of a Site Waste Management Plan (SWMP) and Waste and Resource Action Programme (WRAP)	Yes

Legislation / Policy	Description of Interaction	Compliance
	Construction Commitments the specific commitments relating to materials would be addressed. Transport Scotland state that they have an aim *to embed resource efficiency into our practices*.	
Making Things Last: A Circular Economy Strategy For Scotland, 2016[x] / Choosing Our Future: Scotland's Sustainable Development Strategy, 2005[xi]	These documents outline the Scottish Government's aims for the implementation of sustainable development into Scottish society and the related objectives that concern materials management. The Proposed Scheme has an overarching aim to implement the waste hierarchy through minimising wastage and maximising reuse where possible.	Yes
Scottish Planning Policy (2014)	The Proposed Scheme would aim through design and during construction / operation to minimise waste produced.	Yes

18.5. Mitigation

18.5.1. At DMRB Stage 3, the design of the Proposed Scheme has been sufficiently developed to allow detailed mitigation to be specified based on current legislation, guidance and good practice to minimise the impacts on material resource and waste facilities, wherever possible. Mitigation for some impacts regarding Materials has been considered primarily through the design process detailed in earlier chapters (Chapter 4 Design Development and Chapter 5 The Proposed Scheme).

Mitigation During Construction

18.5.2. Standard measures to mitigate potential impacts associated with the use and consumption of materials and the production and management of waste during construction are detailed in Table 18.15 below. Further details relating to timing of mitigation and consultation/approval requirements are also set out in Chapter 21: Schedule of Environmental Commitments.

18.5.3. Table 18.15 details the standard mitigation measures that have been specified as environmental commitments in the contract documents to ensure implementation by the appointed Contractor.

Table 18.15: Standard A9 Mitigation

Mitigation Item	Description
SMC-M1	Prior to construction, a Site Waste Management Plan (SWMP) will be developed as part of the Construction Environmental Management Plan (CEMP) (See Mitigation Item S1) to set out how all construction phase materials will be managed and it will be updated regularly during the construction of the Proposed Scheme. The Plan will identify, prior to the start of construction works, the types and likely quantities of wastes that may be generated and it will set out, in an auditable manner, how waste will be reduced, reused, managed and disposed of in accordance with relevant Zero Waste Scotland Guidance. The Plan will include specific materials management and soil management plans developed under voluntary and industry regulated Codes of Practice including but not limited to: • Construction Code of Practice for Sustainable Use of Soils on Construction Sites (DEFRA, 2009); • Land Remediation and Waste Management Guidelines (SEPA, 2009); and

Mitigation Item	Description
	• Promoting the Sustainable Reuse of Greenfield Soils in Construction (SEPA, 2010). Appropriate waste minimisation and associated KPI targets will also be included.
SMC-M2	The Contractor will comply with all relevant waste legislation in relation to waste handling, storage, transport and disposal (e.g. The Waste Framework Directive) and consultation with SEPA for advice on waste practices, licences and exemptions where appropriate.
SMC-M3	The Contractor will apply the principles of the 'Waste Hierarchy' (Prevention, Prepare for Reuse, Recycling, Other Recovery, Disposal) to minimise waste generation, maximise re-use of site-won materials on-site and minimise the need for disposal of waste. Where re-use of not possible within the Proposed Scheme, alternative re-use and recycling options will be sought off-site with disposal the final option, with clear justification of options provided.
SMC-M4	The Contractor will implement Zero Waste Scotland's Design for Resource Efficient Construction Principles.
SMC-M5	The key material elements (i.e. aggregates, asphalt, cement, precast concrete products, ready-mixed concrete and steel) used within the Proposed Scheme shall be specified to be responsibly sourced.
SMC-M6	All timber and timber products shall be sourced from independently verifiable legal and sustainable sources.
SMC-M7	Alternatives to primary aggregates will be investigated, including opportunities to use recycled or secondary aggregates in the construction of the Proposed Scheme; either sourced from construction, demolition and excavation waste obtained on-site or off-site; or secondary aggregates obtained from a non-construction or post-consumer or industrial by-product source.
n/a	Further to the above, the following mitigation items detailed in Chapter 21: Table 21.2 (Community and Private Assets), Table 21.4 (Geology, Soils and Contaminated Land), Table 21.5 (Road Drainage and the Water Environment) and Table 21.9 (Air Quality) will be implemented to ensure the appropriate management and handling of materials: Mitigation Items SMC-CP8, SMC-G3, SMC-G8, SMC-G9, SMC-G11, SMC-G15, SMC-W2, SMC-W6 to SMC-W10, SMC-AQ1 and SMC-AQ2.

18.5.4. Further details on specific measures that will allow the implementation of the standard mitigation measures are provided in Table 18.16 below.

Summary

18.5.5. Table 18.16 below provides a summary of the impacts and proposed mitigation as required by HD212/11 (Detailed Assessment Reporting Matrix).

Table 18.16: Detailed Assessment Reporting Matrix with Mitigation Measures

Project Activity	Potential Impacts Associated with Material Use / Waste Production	Description of the Impacts (All considered to be direct, long term, & permanent)	Brief Description of Mitigating Measures	Description of how the Measures would be Implemented, Measured and Monitored.	Residual Impact
Site Preparation	Impacts associated with site clearance – removal of redundant existing features for recycling / disposal.	Removal of material off-site with most likely management option being the composting / recycling of materials. Potential for some waste disposal but exact quantity cannot be quantified at present as reuse locations are not known. Based on currently quantifiable elements and assuming off-site composting and recycling, sensitivity of receptor is Medium, magnitude of impact is Minor, and significance is Slight**.** Impact is temporary, adverse and direct.	The A9 Standard Mitigation Measures shall be adopted during site preparation and any demolition work. In line with the A9 Standard Mitigation Measures, the following should be considered. Prior to construction, a SWMP and Construction Environmental Management Plan (CEMP) will be developed to set out how all materials will be managed. Limit the amount of waste going off site through minimising mixing with underlying soils to limit volume of arisings. Explore potential for fencing to be reused on or off-site.	A SWMP and CEMP shall be put in place and adhered to by the contractor. This should be regularly updated during the construction of the scheme. The SWMP will identify the types and quantities of wastes that will be generated and will clearly define how waste will be reduced, reused, managed and disposed of. The quantity, source location and reuse location of all soil materials shall be recorded. All reused made ground materials should undergo chemical testing at an appropriate frequency to demonstrate their suitability for reuse. Groundwater monitoring should be carried out prior to during and post construction to demonstrate that materials reuse has not impacted on the Water Environment. Materials management records will be maintained throughout all stages of the development to support the SWMP and to allow this to be audited effectively.	Residual impact: Minor, Adverse, temporary, short-term, direct. Residual Significance: Slight
Demolition	Demolition of structures	After processing, it is likely that most materials will be suitable for reuse on or off-site and the available information indicates the majority of demolition materials can be reused on-site. Where appropriate, materials should be shown to be suitable for reuse through appropriate testing. Assuming that the majority of materials will be reused on-site, the sensitivity of the identified waste receptor is Medium, magnitude of impact is			Residual impact: Negligible, adverse, temporary, short-term, direct. Residual Significance: Neutral / Slight

Project Activity	Potential Impacts Associated with Material Use / Waste Production	Description of the Impacts (All considered to be direct, long term, & permanent)	Brief Description of Mitigating Measures	Description of how the Measures would be Implemented, Measured and Monitored.	Residual Impact
		Negligible, and significance is Neutral / Slight. Impact is temporary, adverse and direct.		This information should include but not be limited to site delivery notes, comprehensive recording of all wagon movements on and off site, and waste transfer notes. Site records will demonstrate compliance with all relevant waste legislation in relation to waste handling, storage, transportation and disposal. A copy of all relevant documentation shall be retained on-site for reference. Clear justification of the chosen materials management options shall be recorded within the SWMP. This will provide justifiable reasoning for any deviations from the waste hierarchy e.g. demonstrate that all reasonable attempts have been made to identify reuse options but that this will entail excessive cost or transportation where disposal has been opted for.	
Site Construction	Depletion of natural resources	If only off-site primary resources are utilised to meet the mineral requirements of the Proposed Scheme then this would account for approximately 22-26% of the yearly annual production within the study area based on data for 2012. However, aggregates derived from site activities e.g. from areas of rock cut or derived from demolition activities will be reused to partially meet the Proposed Scheme's requirement for aggregate. This will reduce the consumption of primary mineral resources during construction to approximately 16-20% of the yearly annual production within the study area based on data for 2012. Current indications are that up to approximately 235,466m^3 of aggregate can be sourced though the reuse of construction arisings. As there will still be a requirement to use off-site primary resources, the sensitivity of these primary mineral receptors is Low, the magnitude	The A9 Standard Mitigation Measures shall be adopted during the construction phase. In line with the A9 Standard Mitigation Measures, the following should be considered. On-site and practical secondary off-site sources of aggregates and soils should be exhausted before consideration of primary sources. Prevention of mixing of different streams should be realised through appropriate excavation, segregation, stockpiling and transportation of materials. Materials should be ordered to arrive when required for construction and as site storage capacity allows. Quantities should be accurately predetermined and storage capacity at site should be sufficient to prevent unnecessary wastage;		Residual Impact: Minor, adverse, permanent, direct. Residual Significance: Neutral / Slight

Project Activity	Potential Impacts Associated with Material Use / Waste Production	Description of the Impacts (All considered to be direct, long term, & permanent)	Brief Description of Mitigating Measures	Description of how the Measures would be Implemented, Measured and Monitored.	Residual Impact
		of the impact is Minor, and significance is Neutral / Slight. Impact is permanent, adverse and direct.	Damage to materials during their receipt and storage could be minimised by adhering to manufacturers' guidelines and using designated areas with competent personnel using appropriate equipment to offload materials;		
	Embodied carbon emissions due to use of substantial amounts of material resources.	Overall embodied carbon emissions are estimated to be in the range of 134,879 – 155,111tCO_2e. As detailed in the methodology, significance of impact cannot be calculated and the assessment is based purely on scale/magnitude of impact. The impact would be adverse and permanent, and the scale of impact is Moderate. Sensitivity cannot be defined.			Residual Impact: Moderate (magnitude), adverse, permanent, indirect.
	Production of large volumes of waste materials.	The available information indicates that all rock and concrete arisings can be reused on-site to partially fulfil aggregate requirements of the Proposed Scheme and the assessment has assumed that on-site reuse options shall be exhausted before other management options are considered. Design information indicates that approximately 38% of surplus site-won soils will have the potential to be reused on-site within on-site landscaping areas and for non-structural	In line with the A9 Standard Mitigation Measures, the following should be considered. A SWMP shall be produced to inform the management of waste arisings and to mitigate their impact. A Soil and Peat Management Plan has been produced and this is presented in Appendix 10.3 and outlines the proposals regarding reuse and disposal of soils and peat. This plan shall be further developed by the		Residual impact: Negligible, adverse, permanent, direct. Residual Significance: Slight This assumes there will be sufficient off-site reuse potential to allow the majority of excess materials to be reused either on or off site. Where this is not the case and re-use does not predominate a

Project Activity	Potential Impacts Associated with Material Use / Waste Production	Description of the Impacts (All considered to be direct, long term, & permanent)	Brief Description of Mitigating Measures	Description of how the Measures would be Implemented, Measured and Monitored.	Residual Impact
		applications. Soils not reused on-site will have the potential to be reused off-site. Given the limited waste facility capacity for inert materials in the study area, it is likely that any disposal will result in increased impact because of a requirement for transportation of these materials outwith the study area. Alternatively, there might be potential for the establishment of a local waste management facility able to process inert waste. It is possible that there will be a potential for off-site reuse of excess soils and this should be explored in line with the waste hierarchy as mitigation. Given that approximately 50% of site arisings can be re-used on-site pre-implementation of mitigation, sensitivity of waste receptor is High, magnitude of impact is Major, and significance is Large/Very Large. Impact is permanent, adverse and direct. The same level of impact will apply when all project stages (site preparation, demolition and construction) are considered collectively.	Construction Contractor prior to commencing construction once more detailed ground investigation available Reuse potential to be maximised by responsible site management measures. Prevention of mixing of different streams should be realised through appropriate excavation, segregation, stockpiling and transportation of materials. Identify off-site locations where there is potential for reuse in advance of construction work and programme construction work to maximise reuse potential at these locations.		large/very large impact will remain.

Project Activity	Potential Impacts Associated with Material Use / Waste Production	Description of the Impacts (All considered to be direct, long term, & permanent)	Brief Description of Mitigating Measures	Description of how the Measures would be Implemented, Measured and Monitored.	Residual Impact
Operation	N/A				N/A

18.6. Residual Impacts

18.6.1. Residual impacts for each project activity have been summarised in Table 18.16 and are also detailed below.

18.6.2. The recommended mitigation measures will effectively limit the impact from site preparation although it is unlikely that these measures will reduce the overall impact significance and therefore the residual impact from site preparation to waste receptors will be Slight.

18.6.3. Similarly, the impact from demolition activities will continue to have a Neutral / Slight significance. Indications are that the majority of demolition material can be reused on-site and so mitigation is unlikely to result in further reduction in impact significance.

18.6.4. With regards to the aggregate and soil requirements of the Proposed Scheme, assuming effective implementation of mitigation measures and based on DMRB Stage 3 level of design, reliance on primary mineral resources can be minimised but not avoided. A residual neutral / slight impact to primary resource receptors from construction impacts will exist after considering mitigation measures.

18.6.5. Potential waste impacts will be present during site preparation / demolition and construction phases and collectively these will result in an impact significance of Large/Very Large (High sensitivity, Major magnitude). The unmitigated impact will be permanent, adverse and direct. Residual impacts relating to waste are not able to be absolutely predicted due to them being dependent on the availability of off-site reuse locations and their ability to accept arisings from the Proposed Scheme. The potential for this cannot be quantified at present but assuming that the majority of excess materials will be diverted from a disposal management route through reuse either on or off-site then there will be a Slight impact to waste receptors from construction. The assessment has assumed that sufficient off-site reuse options shall be identified but where insufficient off-site reuse potential exists and re-use does not predominate then a Large/Very Large impact significance shall remain.

18.6.6. Whilst the recommended mitigation measures will effectively limit the impact from embodied carbon associated with materials resources it is unlikely that these measures will reduce the overall impact magnitude from the calculated 134,879 tCO_2e to below 40,000 tCO_2e for the Proposed Scheme and therefore the residual impact from embodied carbon emissions will continue to have a major magnitude. An indirect impact on primary resources was also identified as a result of materials derived from secondary and manufactured sources although this cannot be quantified due to insufficient information.

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