


# Appendix A19.1: Baseline Conditions

## 1.1 Introduction

- 1.1.1 This Appendix provides a detailed description of the baseline conditions of the water features (WF) referred to in Chapter 19 (Road Drainage and the Water Environment) and as shown on Figure 19.1 (Surface Water Features).
- 1.1.2 As described in Chapter 1 (Introduction), the southern section of the A9 Dualling Programme is comprised of five projects (from the Pass of Birnam to Glen Garry). The majority of the identified water features ('WFs': including major to minor watercourses and drainage ditches), within this southern section were referenced sequentially from south to north (with occasional late additions appearing out of sequence).
- 1.1.3 The baseline study area for this assessment extends 500m from the footprint of the proposed scheme and includes identified water features ('WFs': including major to minor watercourses and drainage ditches), existing watercourse crossing points and flood inundation extents. It should be noted that where the potential for flood risk impacts due to the scheme has been observed to extend beyond the 500m study area in areas of the River Tay floodplain these have been included within the assessment. WF03 and WF03A are scoped out of this baseline as they exhibit no discernible channel.
- 1.1.4 Importance has been assigned based on the Importance criteria provided in Table 19.6 of Chapter 19 (Road Drainage and the Water Environment). For watercourses classified as main stem water bodies by the Scottish Environment Protection Agency (SEPA) under the Water Framework Directive (WFD) this is based upon 2023 classification data available on the [SEPA Water Classification Hub](#) (SEPA, 2025). Where no information was available, professional judgement was used to assign an Importance based on site observations and other sources of information.
- 1.1.5 It should be noted that the attribute 'Surface Water Supply' has only been included where a public or private water supply (PWS) has been identified within the 500m study area.
- 1.1.6 Further details on the baseline flood risk conditions can be found in Appendix A19.2 (Flood Risk Assessment).
- 1.1.7 Further baseline information on the existing watercourse crossing structures is reported in Appendix A19.3 (Watercourse Crossings Report).

**Table A19.1-1: WF01 (Birnam Burn)**

Overview		
 <p><b>Photograph 1: WF01 (Birnam Burn) – upstream view, upstream of the existing A9</b></p>	Water feature type: Minor watercourse	
	Catchment Area: 4.38km <sup>2</sup>	
	Key hydraulic connections: Sourced on the south-east slopes of King's Seat, formed of two channels which converge and drain into Robin's Dam and then Rohallion Loch, which has outlets at Rohallion Cottage and Byres of Murthly Sawmill. Channels converge south of the Highland Main Line railway at Pass of Birnam, and pass under, then flows down and under the A9 and drain into the River Tay downstream of Roman Bridge.	
	Surrounding land use: Mixed forestry, ancient woodland, rough pasture, arable agricultural, road and rail infrastructure.	
Description of Specific Baseline Conditions		Importance
<b>Flood Risk</b>		
<p>The watercourse is situated in a narrow deeply incised valley upstream of the A9. As a result, <a href="#">SEPA Flood Maps</a> (2024a) indicate no significant flooding for the 0.5% AEP (200-year) event from overtopping along WF01 (Birnam Burn). The mapping shows a small area of flood risk to the existing A9 at its crossing of WF01. However, the SEPA extents do not take account of engineering structures. Multiple properties are located within 100m of the watercourse at Dairy Cottage and Railway Cottages, and at Colryden Lodge.</p> <p>Hydraulic assessment indicates the watercourse is in-bank upstream of the A9 in the design 0.5% AEP (200-year) plus climate change (CC) event. There is &gt;600mm freeboard to the A9 and therefore flood risk is considered low.</p>		low
<b>Hydromorphology</b>		
<p>SEPA Morphology status: not classified.</p> <p>The watercourse displays a low sinuosity planform with steep step-pool and uniform rapid flow types in upstream reaches and tumbling flow types in downstream reaches where the channel has been heavily modified. Bedforms comprise boulder steps and pools with plane-</p>		medium

riffle and plane-bed features upstream and bedrock cascades within the confines of an engineered channel downstream of the existing A9 carriageway. The gravel material appears to be mobile and forms alternate, lateral bars.

Existing pressures include:

- culverted beneath the Highland Main Line railway for approximately 50m, a local access track for approximately 4m, the existing A9 for approximately 65m, followed by two further local access tracks for approximately 4m and 5m prior to discharging to WF06 (River Tay);
- lengths of bank and bed protection associated with culvert structures;
- engineered cascades with masonry reinforced walls extending 30m downstream of the existing A9 culvert; and
- seven-span Roman Bridge which is in poor structural condition located 85m downstream of the existing A9 culvert (Bridge piers span the active channel width).

The watercourse is stable under the existing conditions and artificial constraints, in that it appears to be competent to transport the water and sediment supplied from upstream without excessive erosion or deposition.

#### Surface Water Quality

SEPA Physico-chemical/ Biological elements/ Specific pollutants status: not classified.

Low flow value ( $Q_{95}$ ): 0.0195m<sup>3</sup>/s

The catchment contains Mill Dam SSSI due to species-rich basin fen.


Diffuse run-off may occur from land uses within the catchment. The majority of the catchment comprises of ancient and historic woodland (~54%) which may be sources of sediment, dissolved organic carbon and nutrients. Run-off from agriculture, open moorland and rough grazing within the catchment could include high nutrient levels (nitrogen and phosphorous) from agricultural fertilizers as well as biological pollutants from rough grazing and farmland. Run-off from urban development (including the existing A9 and the Highland Main Line railway) includes suspended solids and contaminants bound to them (such as heavy metals and phosphorus); de-icing salt (chloride), oil and related compounds.

Within the 500m study area, no CAR Licences are associated with the watercourse.

medium



**Table A19.1-2: WF02**

<b>Overview</b>	
 <p><b>Photograph 2: WF02</b></p>	Water feature type: Minor watercourse
	Catchment Area: 0.25km <sup>2</sup>
	Key hydraulic connections: Sourced in south-east slopes of Duncan's Hill, the channel appears north of the Highland Main Line railway at Pass of Birnam, joins WF01 (Birnam Burn) immediately downstream of a historic Roman Bridge, which then drains into the River Tay.
	Surrounding land use: Mixed forestry, ancient woodland, rough pasture, arable agricultural, road and rail infrastructure.
<b>Description of Specific Baseline Conditions</b>	
<b>Flood Risk</b>	
<p>This watercourse has a catchment area less than 3km<sup>2</sup> so is not included in the SEPA Flood Map.</p> <p>Roman Bridge Cottage is located within 100m of the watercourse.</p> <p>Hydraulic assessment indicates that the watercourse is out of bank upstream of the A9 in the design 0.5% AEP (200-year) plus CC event. However, there is &gt;600mm freeboard to the A9 and therefore flood risk is considered low.</p>	low
<b>Hydromorphology</b>	
<p>SEPA Morphology status: not classified.</p> <p>The watercourse displays a low sinuosity planform with steep step-pool flow types in reaches upstream of the existing A9, and exhibits a variable cross-section, with the formation of alternate berms suggesting localised recovery of sinuosity within the confines of an engineered channel in downstream reaches. Bedforms comprise boulder/cobble steps and pools with plane-riffle and plane-bed features. WF02 is poorly channelised prior to discharging into WF01 (Birnam Burn) at the Roman Bridge.</p> <p>Existing pressures include:</p>	medium

- culverted through a masonry box culvert for approximately 5m upstream of the existing A9. WF02 crosses the existing A9 for approximately 50m through a 75cm diameter concrete pipe culvert and associated drop chamber entrance. A third culvert conveys the water feature below a local access track via a masonry box culvert for approximately 14m;
- concrete steps (cascade) with concrete wing walls extend 8m downstream of the existing A9 culvert (a road drainage outfall also discharges on to the cascade at the downstream culvert exit); and
- poorly channelised downstream of local property access where the water feature is conveyed below a local access footpath through a broken ceramic pipe prior to an approximate 10m drop over a masonry wall, discharging into WF01 (Birnam Burn).

The watercourse is stable under the existing conditions and artificial constraints, such that it appears to transport the water and sediment supplied from upstream without excessive erosion or deposition.

#### Surface Water Quality

SEPA Physico-chemical/ Biological elements/ Specific pollutants status: not classified.

Low flow value ( $Q_{95}$ ): 0.0011m<sup>3</sup>/s

Located upstream of the River Tay SAC but the watercourse itself is considered to exhibit 'Poor' ecosystem quality due to reduced connectivity to the wider catchment or a lack of resources to support fish species of conservation interest.


Upper catchment contains Mill Dam SSSI due to species-rich basin fen.

Diffuse run-off may occur from land uses within the catchment. The majority of the secondary channel catchment comprises of ancient and historic woodland (~80%) which may be sources of sediment, dissolved organic carbon and nutrients. Run-off from agriculture within the catchment could include high nutrient levels (nitrogen and phosphorous) from agricultural fertilizers as well as biological pollutants from rough grazing and farmland. Run-off from urban development (including the existing A9 and the Highland Main Line railway) includes suspended solids and contaminants bound to them (such as heavy metals and phosphorus); de-icing salt (chloride), oil and related compounds.

Within the 500m study area, no CAR Licences are associated with the watercourse.


medium

**Table A19.1-3: WF04**

Overview		
 <p><b>Photograph 3: WF04</b></p>	Water feature type: Drainage channel	
	Catchment Area: 0.07km <sup>2</sup> . Length of watercourse: <40m	
	Key hydraulic connections: Sourced on the north-west slopes of Duncan's Hill, channel occurs north of the Highland Main Line railway and the B867 and sinks at Ringwood Cottage south of the A9. No crossing with the A9 found on site and no crossing shown on as-built drawings.	
	Surrounding land use: Mixed forestry, ancient woodland, road and rail infrastructure.	
Description of Specific Baseline Conditions		Importance
<b>Flood Risk</b>		
<p>No crossing with the A9 identified. This short watercourse (&lt;40m long) has a catchment area less than 3km<sup>2</sup> so is not included in the SEPA Flood Map.</p> <p>This watercourse emerges from a spring upstream of a row of four cottages and disappears into a sink immediately upstream of the access road to the cottages. It appears to be groundwater-fed with little surface water contribution as surface contours are broadly perpendicular to the stream. The risk of any surface runoff causing the watercourse to flood its banks is therefore low. As a consequence, the risk of any flooding from the watercourse impacting on the existing A9 is low.</p> <p>Four properties are located within 100m of the watercourse around Ringwood Cottage.</p>		low
<b>Hydromorphology</b>		
SEPA Morphology status: not classified.		low

<p>The watercourse is a land drain and artificial road drain with a straight planform, which displays no clear hydrological connection to the existing A9, proposed scheme or WF06 (River Tay). As WF04 is an artificial land drain and road drain it displays no natural channel morphology or flow types and is likely ephemeral.</p> <p>No existing pressures are noted on the artificial land and road drain.</p>	
<b>Surface Water Quality</b>	
<p>SEPA Physico-chemical/ Biological elements/ Specific pollutants status: not classified.</p> <p>Low flow value (<math>Q_{95}</math>): 0.0003m<sup>3</sup>/s</p> <p>Diffuse run-off may occur from land uses within the catchment. The majority of the catchment comprises of ancient and historic woodland (~95%) which may be sources of sediment, dissolved organic carbon and nutrients. Run-off from urban development (including the existing A9 and the Highland Main Line railway) includes suspended solids and contaminants bound to them (such as heavy metals and phosphorus); de-icing salt (chloride), oil and related compounds.</p> <p>Within the 500m study area, no CAR Licences are associated with the watercourse.</p>	<p>low</p>


**Table A19.1-4: WF05**

Overview	
 <p><b>Photograph 4: WF05</b></p>	Water feature type: Minor watercourse
	Catchment Area: 0.32km <sup>2</sup>
	Key hydraulic connections: Sourced in Rochanroy Wood, on the eastern slopes of Craig Ruenshin. Channel flows north-east to the Highland Main Line railway, which it is culverted under, then under the B867 where it sinks. The channel occurs again further north in Ring Wood.
	Surrounding land use: Mixed forestry, ancient woodland, road and rail infrastructure.
Description of Specific Baseline Conditions	
Flood Risk	
<p>This watercourse has a catchment area less than 3km<sup>2</sup> so is not included in the SEPA Flood Map.</p> <p>Hydraulic assessment indicates that the watercourse is out of bank upstream of the A9 in the design 0.5% AEP (200-year) plus CC event. However, there is &gt;600mm freeboard to the A9 and therefore the flood risk is considered low.</p>	low
Hydromorphology	
<p>SEPA Morphology status: not classified.</p> <p>The watercourse displays a low sinuosity planform with steep step-pool flow types in the upper reaches and uniform tranquil flow types where gradients are shallow. Bedforms comprise boulder and cobble steps and pools, and alternating bar features in upstream reaches. Relict boulders provide bed and bank controls where the channel is not artificially confined.</p> <p>Existing pressures:</p> <ul style="list-style-type: none"> <li>■ culverted beneath a local access track for approximately 5m, the Highland Main Line railway for approximately 30m and the B867 for approximately 20m; and</li> <li>■ lengths of bank and bed protection associated with culvert structures.</li> </ul>	medium

The watercourse is stable under the existing conditions and artificial constraints, in that it appears to be competent to transport the water and sediment supplied from upstream without excessive erosion or deposition.	
<b>Surface Water Quality</b>	
<p>SEPA Physico-chemical/ Biological elements/ Specific pollutants status: not classified.</p> <p>Low flow value (<math>Q_{95}</math>): 0.0014m<sup>3</sup>/s</p> <p>Diffuse run-off may occur from land uses within the catchment. The majority of the catchment comprises of ancient and historic woodland (~90%) which may be sources of sediment, dissolved organic carbon and nutrients. Run-off from urban development (including the Highland Main Line railway) includes suspended solids and contaminants bound to them (such as heavy metals and phosphorus); de-icing salt (chloride), oil and related compounds.</p> <p>Potential pollutants include PBTC-C5 Curling Pond and PBTC-C6 Infilled Pond with potential for contaminants associated with historic activity and infilled with made ground in watercourse.</p> <p>Within the 500m study area, no CAR Licences are associated with the watercourse.</p>	medium




**Table A19.1-5: WF05A**

Overview	
 <p><b>Photograph 5: WF05A (centre of image)</b></p>	Water feature type: Drainage channel
	Catchment Area: 0.43km <sup>2</sup>
	Key hydraulic connections: Sourced on eastern slopes of King's Seat and Birnam Quarry, the channel appears from a culvert on the north side of the Highland Main Line railway, then is culverted under the A9. North of the A9 the channel emerges from the culvert and drains into a marsh bog.
	Surrounding land use: Mixed forestry, ancient woodland, road and rail infrastructure.
Description of Specific Baseline Conditions	Importance
<b>Flood Risk</b>	
<p>This watercourse has a catchment area less than 3km<sup>2</sup> so is not included in the SEPA Flood Map.</p> <p>For the existing A9 culvert, the hydraulic assessment indicates that the watercourse is out of bank upstream of the A9 in the design 0.5% AEP (200-year) plus CC event, however there is &gt;600mm freeboard to the A9 and therefore the flood risk is considered low.</p> <p>For the existing B867 culvert, the hydraulic assessment indicates that the watercourse is out of bank upstream of the railway and A9 in the design 0.5% AEP (200-year) plus climate change (CC) event, however the A9 culvert capacity is greater than the 0.5% AEP (200-year) plus CC peak flow and there is &gt;600mm freeboard to the railway and therefore the flood risk is considered low.</p>	low
<b>Hydromorphology</b>	
<p>SEPA Morphology status: not classified.</p> <p>The watercourse displays a low sinuosity planform with a uniform tranquil and occasional steep step-pool flow types before ponding and dissipating in marshland north-east of the existing A9 carriageway. Relict boulders provide bed and bank controls where the channel is not artificially confined.</p>	low

<p>Existing pressures:</p> <ul style="list-style-type: none"> <li>▪ culverted beneath the Highland Main Line railway and B867 road for approximately 55m and the existing A9 for approximately 55m; and</li> <li>▪ lengths of bank and bed protection associated with culvert structures. A road drainage outfall is present at the downstream headwall of the existing A9 culvert.</li> </ul> <p>Extensive fine sediment and organic material accumulation in a ponded area on the fluvial terrace downstream of the A9 culvert. Evidence suggests high water velocities during high flow events causes scour in the terrace deposits and a backwater effect at the culvert exit. Historical pressures include an abandoned curling pond just south of B867 road where water sinks into a depression and does not reappear as surface flow until further (~80m) downstream.</p> <p>The watercourse cannot be assessed as “stable” under the current conditions, in that it has been so heavily modified and subjected to ephemeral flow conditions that natural channel morphology criteria cannot be applied.</p>	
<b>Surface Water Quality</b>	
<p>SEPA Physico-chemical/ Biological elements/ Specific pollutants status: not classified.</p> <p>Low flow value (<math>Q_{95}</math>): 0.0019m<sup>3</sup>/s</p> <p>Diffuse run-off may occur from land uses within the catchment. Half of the catchment comprises of ancient and historic woodland (~52%) which may be sources of sediment, dissolved organic carbon and nutrients. Run-off from open moorland and rough grazing within the catchment could include biological pollutants. Run-off from urban development (including the existing A9 and the Highland Main Line railway) includes suspended solids and contaminants bound to them (such as heavy metals and phosphorus); de-icing salt (chloride), oil and related compounds. Potential pollutants include:</p> <p>PBTC-C11 Curling Pond with potential for contaminants associated with historic activity and potentially infilled with made ground; and PBTC-C8 Ringwood Sawmill, PBTC-C9 Birnam Quarry and PBTC-C10 with potential for contaminants associated with historic and current activity, and PBTC-C10 Old Quarry with potential for contaminants associated with historic activity, in the upper catchment of WF5A.</p> <p>Within the 500m study area, no CAR Licences are associated with the watercourse.</p>	medium



**Table A19.1-6: WF06 (River Tay)**

Overview		
 <p><b>Photograph 6: WF06 (River Tay) – view upstream towards Dunkeld and Birnam</b></p>	Water feature type: Major watercourse	
	Catchment area: 3,210km <sup>2</sup>	
	WFD water body: River Tay (R Tummel to R Isla Confluences) Water body ID: 6499	
	Key hydraulic connections: Principal watercourse within the study area. All water features within the study area form part of the River Tay catchment, with the majority being direct tributaries.	
	Surrounding land use: Arable, rough pasture and commercial forestry.	
SEPA Overall Status: Poor ecological potential (2023 classification year)		
Description of Specific Baseline Conditions		Importance
Flood Risk		
<p>The River Tay flows in a generally southerly direction through the study area and has a catchment area of 3,210km<sup>2</sup> upstream of the gauging station at Caputh (NGR: NO 08389 39575) (approximately 3.1km downstream of the study area). The River Tay is crossed by the existing A9 in the north of the study area at the Tay Crossing. The River Tay passes in close proximity to a number of settlements including (north to south) Inver, Dunkeld, Little Dunkeld and Birnam.</p> <p>SEPA Flood Maps (2024a) indicate fluvial flood risk from the 0.5% AEP (200-year) event to properties on the left bank of the River Tay including a small Sewage Treatment Plant within the grounds of Dunkeld House Hotel. The most notable risk is to properties within Dunkeld including; High Street (approximately 7 properties), Bridge Street (A923) (approximately 10 properties), Atholl Street (A923) (approximately 7 properties), Cathedral Street (approximately 7 properties) and Water Wynd (approximately 3 properties). On the right bank of the River Tay properties within Little Dunkeld are predicted to be at risk, including approximately 75 properties within Willowbank and 8 properties along Burnmouth Road. Properties within Birnam (approximately 8 properties along Torlee Road) are also predicted to flood, as well as Birnam &amp; Dunkeld Sewage Treat Works (National Grid Reference (NGR): NO 04156 41061) south of Birnam.</p>		very high

SEPA Flood Maps (2024a) also shows a section of the existing A9 of approximately 650m between the WF11 (River Braan) crossing and the WF12 (Mill Stream) crossing is located in the floodplain of WF06 (River Tay) and WF11 (River Braan). Most of this section would be overtopped in a 0.5% AEP (200-year) flood. Along the rest of the existing A9 within the study area, the 0.5% AEP (200-year) functional floodplain does not impact on the carriageway.

Detailed baseline hydraulic modelling by Jacobs in Appendix A19.2 (Flood Risk Assessment) shows similar flood extents for the 0.5% AEP (200-year) plus climate change (CC) flood to the 0.5% AEP SEPA Flood Mapping. However, in most places the flooding shown by the Jacobs model is less than that shown on the SEPA flood map. This is primarily attributed to updated hydrology and a more refined topographic representation in the Jacobs model. The Jacobs model for the 0.5% AEP (200-year) plus CC flood event shows the following notable areas of flooding:


- flooding of up to 6.9m on the right bank of the River Tay (when facing downstream), upstream of the existing River Tay crossing on both sides of the Highland Main Line railway at Inchmagrannachan. The B898 and HML Railway are overtopped. From NGR NO 00539 44259 to NO 00516 44603 (road chainage 8000 to 8400) the A9 is flooded from the Tay left bank for a length of ~290m and area of ~4,000m<sup>2</sup> with an average depth of ~0.3m and maximum flood depth of ~0.5m predicted
- overtopping of the wooded right bank of the River Tay at the Dalguise Junction, causing floodwater to flow north into agricultural land and flood an area within 3m of the Highland Main Line railway embankment;
- overtopping of the right bank of the River Tay, north of the WF12A crossing, flooding of woodland within 6m of the Highland Main Line railway embankment;
- overtopping of the right bank of the River Tay, flooding agricultural land on the right bank, opposite Dunkeld House Hotel, this extends to within 10m of the A9 southbound embankment at Inver;
- floodwater from WF11 (River Braan) and WF12 (Mill Stream) at Inver will merge with floodwater from the River Tay, ponding against the A9 embankment and flooding the existing A9 carriageway over a length of several hundred metres to varying depths up to 0.6m;
- both banks of the River Tay flood from the River Braan confluence to the Inchewan Burn confluence, to affect 45-55 properties (including the Royal School of Dunkeld) in Little Dunkeld, and 60-65 properties in Dunkeld;
- overtopping of the right bank of the River Tay, flooding an area of Birnam to the north of Oak Road includes a playground and three properties partially in the floodplain (Tayview Cottage, Tayview House, Merlewood); and
- flooding adjacent to the proposed Birnam Junction, from the River Tay affecting the sewage treatment works site on the right bank and approximately 10 residential properties at Torlee Road.

## Hydromorphology

<p>SEPA Morphology status: Bad (2023 classification year). The WFD water body has been designated as a heavily modified water body on account of physical alterations that cannot be addressed without a significant impact on water storage for hydroelectricity generation (SEPA 2025).</p> <p>Within the study area, WF06 (River Tay) flows typically south with a sinuous, meandering, single-thread planform. The floodplain is relatively confined throughout this reach with a fragmentary riparian corridor. The river displays various flow types, with predominantly uniform/tranquil flow types within the study area. A wide range of morphological features are present throughout the study area, including numerous locations with large accumulations of pebble and cobble deposits, including point and mid-channel bars (both vegetated and unvegetated), riffles, pools and sections of plane-bed. Bed material comprises boulders, gravel and cobbles. Bridge abutments and boulders provide bank controls. The cobble and boulder bed-material appear to be mobile and forms occasional alternate bars and point bars which display a characteristic imbricated pattern.</p> <p>Existing pressures within the study area include:</p> <ul style="list-style-type: none"> <li>▪ The A9 at Dalguise, which is currently conveyed over WF06 (River Tay) by a three-span bridge. One bridge pier is installed into the channel adjacent to a lateral bar and is showing signs of scour and outflanking where the steel-piling has been exposed. The channel banks are reinforced by gabion baskets extending to a height of 4-5m above the channel and 100m along the bank line. The gabion baskets are currently eroding and have failed on the left bank at the bridge pier, and there is evidence the pier is outflanked during high flows with further erosion of gabion reinforcement. Site surveys also noted geotechnical failures associated with poorly consolidated left bank sediments.</li> <li>▪ Dunkeld Bridge, linking Birnam and Dunkeld, also crosses WF06 (River Tay) within the study area. Dunkeld Bridge is a seven-span rubble bridge with segmental arches; the four central piers are located in-channel with two piers and two abutments located on the banks.</li> <li>▪ Within the wider River Tay catchment, anthropogenic modifications are widespread and affect multiple tributaries. The most significant impact within the River Tay catchment is related to the construction of impoundments (dams) and creation of reservoirs to control flow within the River Garry and River Tummel sub-catchments for the <a href="#">Tummel Hydro Schemes</a> (SSE Renewables, 2021), a large hydroelectricity generation scheme comprising 9 power stations, 4 major dams constructed between 1930 and 1962. Numerous smaller dams, weirs and flow diversions (tunnels) are also present across the catchment as part of the scheme.</li> </ul>	<p>very high</p>
<p><b>Surface Water Quality</b></p>	
<p>SEPA Physico-chemical/Biological elements/Specific pollutants status: High/ Good/ Pass (2023 classification year).</p> <p>Low flow value (<math>Q_{95}</math>): 33.37m<sup>3</sup>/s</p>	<p>very high</p>

<p>Presence of freshwater pearl mussels, Atlantic salmon, trout and brook lamprey within the downstream catchment, all of which have international importance as detailed in Chapter 12 (Biodiversity), including the River Tay SAC.</p> <p>Diffuse run-off may occur from land uses within the catchment. The majority of the catchment comprises of open moorland with rough grazing and farmland, which may be sources of high nutrient levels (nitrogen and phosphorous) from agricultural fertilizers as well as biological pollutants from rough grazing and farmland. Surface run-off from forestry (~18%), ancient and historic woodland (~10%) also within the catchment could include sediment, dissolved organic carbon and nutrients. Surface run-off from urban development (including the existing A9 and the Highland Main Line railway) includes suspended solids and contaminants bound to them (such as heavy metals and phosphorus); de-icing salt (chloride), oil and related compounds.</p> <p>Within the 500m study area, the following CAR Licences are associated with the watercourse:</p> <ul style="list-style-type: none"> <li>▪ seven point sources from Combined Sewer Overflow (CSO) discharges;</li> <li>▪ one point sources for engineering works associated with bank reinforcement; and</li> <li>▪ one point source from Sewage Treatment Works (STWs) discharge.</li> </ul>	
<b>Surface Water Supply</b>	
<p>One surface water supply abstraction from the River Tay within the study area, an agricultural abstraction at Inchmagrannachan Farm for irrigation – mobile plant at approximately National Grid Reference (NGR) NO 00110 44479.</p>	<p>high</p>


**Table A19.1-7: WF07**

Overview		
 <p><b>Photograph 7: WF07</b></p>	Water feature type: Drainage channel	
	Catchment Area: 0.59km <sup>2</sup>	
	Key hydraulic connections: Sourced on north-east slopes of King's Seat/ Birnam Hill. Spreads out on slopes 150m south-east of Highland Main Line railway, dry channel continues to rail line, culverted under, spreads out south of A9.	
	Surrounding land use: Mixed forestry, ancient woodland, rough grazing, road and rail infrastructure.	
Description of Specific Baseline Conditions		Importance
<b>Flood Risk</b>		
<p>This watercourse has a catchment area less than 3km<sup>2</sup> so is not included in the SEPA Flood Map.</p> <p>Hydraulic assessment of the existing culvert beneath the Highland Main Line railway and existing A9 during the 0.5% AEP (200-year) plus CC event indicates that the A9 is at risk of flooding as headwater level is above the existing A9 road level. Investigations into the culvert to the River Tay have indicated that the culvert capacity is unlikely to convey the design flow and that the condition of the structure is unknown. Manholes have been identified at Perth Road which also appear to include surface water contributions from surrounding catchments.</p>		very high
<b>Hydromorphology</b>		
<p>SEPA Morphology status: not classified.</p> <p>The watercourse displays a low sinuosity planform with steep step-pool and tumbling flow types in upstream reaches and uniform rapid to tranquil in lower reaches. Bedforms comprise boulder steps and pools with plane-riffle and plane-bed features. Relict boulders provide bed and bank controls where the channel is not artificially confined. No open channel identified downstream of inlet to Highland Main Line railway culvert.</p>		low

<p>Existing pressures:</p> <ul style="list-style-type: none"> <li>▪ culverted via 2.6m offline box culvert for approximately 15m beneath the Highland Main Line railway; and</li> <li>▪ ephemeral channel</li> </ul> <p>The watercourse cannot be assessed as “stable” under the existing conditions, in that it is subject to ephemeral flow conditions that it precludes applying “natural channel morphology” criteria.</p>	
<b>Surface Water Quality</b>	
<p>SEPA Physico-chemical/ Biological elements/ Specific pollutants status: not classified.</p> <p>Low flow value (<math>Q_{95}</math>): 0.0026m<sup>3</sup>/s</p> <p>Diffuse run-off may occur from land uses within the catchment. The majority of the catchment comprises of ancient and historic woodland (~82%) which may be sources of sediment, dissolved organic carbon and nutrients. Run-off from urban development (including the existing A9 and the Highland Main Line railway) includes suspended solids and contaminants bound to them (such as heavy metals and phosphorus); de-icing salt (chloride), oil and related compounds.</p> <p>Within the 500m study area, no CAR Licences are associated with the watercourse.</p>	<p>medium</p>



**Table A19.1-8: WF08 (Inchewan Burn)**

Overview	
 <p><b>Photograph 8: WF08 (Inchewan Burn) – (typical example of a medium water feature)</b></p>	Water feature type: Medium watercourse
	Catchment Area: 5.77km <sup>2</sup>
	Key hydraulic connections: Sourced on north and north-west slopes of Obney Hills and drains Balhomish Loch. Watercourse flows north-east to Little Dunkeld and Birnam, culverted under roads and the Highland Main Line railway, and drains into the River Tay north-east of Burnmouth Road.
	Surrounding land use: Mixed forestry, ancient woodland, exposed moorland, rough grazing, road and rail infrastructure and urban.
Description of Specific Baseline Conditions	
Flood Risk	
<p>WF08 (Inchewan Burn) flows in a generally north east direction before meeting WF06 (River Tay) at Birnam in the study area and has a catchment area of 5.77km<sup>2</sup>. WF08 (Inchewan Burn) is crossed by the existing A9 close to the Dunkeld and Birnam Station. WF08 (Inchewan Burn) passes in close proximity to Little Dunkeld and Birnam and flows into the River Tay SAC.</p> <p>SEPA Flood Maps indicate that the majority of the existing A9 between Pass of Birnam and the Tay Crossing is located outwith of the predicted 0.5% AEP (200-year) flood extent, and not at risk from WF08 (Inchewan Burn).</p> <p>Baseline hydraulic modelling of the 0.5% AEP (200-year) plus CC flood event and the SEPA Flood Maps have similar flood extents in some areas, however there are areas where the flood extents differ. Due to backwater effects near the confluence with the River Tay, the model predicts the Inchewan Burn to overtop and floodwater to merge with floodwater from the River Tay, inundating Little Dunkeld and affecting 40-50 properties, including the Royal School of Dunkeld between the A923 Tay crossing and the WF08 (Inchewan Burn) confluence.</p>	very high
Hydromorphology	
SEPA Morphology status: not classified.	high

The watercourse displays a low to medium sinuosity planform with steep step-pool, tumbling and uniform/rapid flow types. Bedforms comprise bedrock cascades, boulder steps and pools, and cobble/gravel plane-riffles. The finer sand and gravel bed-material appears to be mobile, forming alternate, lateral bars. Bedrock outcrops, glacial erratics and boulders provide bed and bank controls.

Existing pressures:

- a weir structure approximately 5m in length, 900m upstream from the A9 road bridge is associated with a broad, shallow pool upstream, 15m in length, which is infilling with gravel- and sand-size sediment. The backwater effect from the in-filling pond and weir extends approximately 12m upstream;
- a setback dry-stone wall which affects 700m of the left bank downstream from the weir;
- a discontinuous stone retaining wall upstream from the railway bridge which affects 280m of right bank;
- a wooden foot bridge approximately 400m upstream from the A9 road bridge with a single abutment in the channel bed;
- cobble and concrete bed protection affecting approximately 220m of the channel bed extending from a bedrock waterfall to the confluence with the River Tay; and
- artificial steps and pools have been constructed downstream from the Highland Main Line Railway and under the existing A9 road bridge. It is understood that these features were created to replace former gabion bed reinforcement. The artificial steps and pools are largely intact, however, there is evidence of undercutting, incision and mid-channel deposition suggesting mild instability. The right and left banks are also constrained by 70m of gabion baskets through the artificial step-pool reach, and further constrained by stone blockwork and boulders 420m downstream to the footbridge near the River Tay confluence.

Historic pressures include straightening downstream of the Highland Main Line railway since 1867, and the upstream dam, pond and weir structures which do not appear on maps prior to 1948.

The watercourse is stable under the existing conditions and artificial constraints, in that it appears to be competent to transport the water and sediment supplied from upstream without excessive erosion or deposition.

#### Surface Water Quality

SEPA Physico-chemical/ Biological elements/ Specific pollutants status: not classified.

Low flow value ( $Q_{95}$ ): 0.0257m<sup>3</sup>/s

Located upstream of the River Tay SAC but the watercourse itself is considered to exhibit 'Good' ecosystem quality due to its connectivity to the main stem of the River Tay and the presence of some suitable supporting habitat.

Diffuse run-off may occur from land uses within the catchment. The majority of the catchment comprises of open moorland with rough grazing which may be sources of biological pollutants from rough grazing and farmland. Run-off from forestry, ancient and historic

medium




woodland (~31%) within the catchment could include sediment, dissolved organic carbon and nutrients. Run-off from urban development (~2%) (including the existing A9 and the Highland Main Line railway) includes suspended solids and contaminants bound to them (such as heavy metals and phosphorus); de-icing salt (chloride), oil and related compounds.

Potential pollutants include:

- PBTC-C19 Old Coach Works and Smithy and PBTC-C22 Disused Quarry (now Ladywell Landfill) with potential for contaminants associated with historic activity – each less than 10m from watercourse. PBTC-C22 has potential for contaminants associated with current site activity as Ladywell Landfill; and
- PBTC-C20 Filter beds and PBTC-C21 Fuel Station, Garage and Car Dealer potential for contaminants associated with historic and current site activity – 30m and 10m from watercourse respectively.


Within the 500m study area, no CAR Licences are associated with the watercourse.

**Table A19.1-9: WF09**

Overview	
 <p><b>Photograph 9: WF09 – (typical example of a small water feature)</b></p>	Water feature type: Minor watercourse
	Catchment Area: 0.76km <sup>2</sup>
	Key hydraulic connections: Sourced north-east of Balhomish Loch and slopes of Ladywell Plantation. Watercourse flows north-east to the A822, then is culverted from Ladywell Cottage to just south of the A9, culverted under the A9 and under roads in Little Dunkeld and Birnam, and drains into the River Braan by the recreational grounds.
	Surrounding land use: Mixed forestry, ancient woodland, arable agricultural, urban and recreational, road and rail infrastructure.
Description of Specific Baseline Conditions	Importance
<b>Flood Risk</b>	
<p>This watercourse has a catchment area less than 3km<sup>2</sup> so is not included in the SEPA Flood Map.</p> <p>Multiple properties are located within 100m of the watercourse at Ladywell Mill, Ladywell Cottage and at Braan Cottage.</p> <p>For the existing A9 culvert, the hydraulic assessment of the existing A9 culvert for the 0.5% AEP (200-year) plus CC flood event indicates that the flow is out of bank and the A9 is at risk of flooding as headwater level is above the existing A9 road level.</p> <p>For the existing culvert beneath the unnamed access road to Dunkeld and Birnam Recreation Club, the preliminary hydraulic assessment indicates that the watercourse is out of bank upstream of the unnamed access road in the design 0.5% AEP (200-year) plus CC event.</p>	very high
<b>Hydromorphology</b>	
<p>SEPA Morphology status: not classified.</p> <p>The watercourse displays a low sinuosity planform with evidence of artificial straightening and realignment, and uniform tranquil and pool-riffle flow types. Bridge protection structures, including culverts and bank revetments provide bed and bank controls. Alternating bars were observed within recovering reaches.</p>	medium

<p>Existing pressures:</p> <ul style="list-style-type: none"> <li>▪ culverted beneath Ladywell Cottage for approximately 38m, the A822 for approximately 420m, the existing A9 for approximately 50m, a local access road for approximately 20m and a public footpath for approximately 2m; and</li> <li>▪ lengths of bank and bed protection associated with culvert structures and straightened /realigned channel.</li> </ul> <p>The watercourse lacks competence under the existing conditions and artificial constraints, in that it appears to be unable to transport the water and sediment supplied from upstream without excessive deposition in reaches downstream from the A9.</p>	
<b>Surface Water Quality</b>	
<p>SEPA Physico-chemical/ Biological elements/ Specific pollutants status: not classified.</p> <p>Low flow value (<math>Q_{95}</math>): 0.0034m<sup>3</sup>/s</p> <p>Located within the River Tay SAC, but the watercourse itself is considered to exhibit 'Poor' ecosystem quality due to reduced connectivity to the wider catchment or a lack of resources to support fish species of conservation interest.</p> <p>Diffuse run-off may occur from land uses within the catchment. The majority of the catchment comprises of ancient and historic woodland (~59%) which may be sources of sediment, dissolved organic carbon and nutrients. Run-off from rough grazing could include biological pollutants. Run-off from urban development (including the existing A9 and the Highland Main Line railway) includes suspended solids and contaminants bound to them (such as heavy metals and phosphorus); de-icing salt (chloride), oil and related compounds.</p> <p>Potential pollutants include PBTC-C22 Disused Quarry (now Ladywell Landfill) with potential for contaminants associated with historic and current activity, 40m away from culverted section of channel.</p> <p>Within the 500m study area, no CAR Licences are associated with the watercourse.</p>	<p>medium</p>

**Table A19.1-10: WF11 (River Braan)**


Overview	
 <p><b>Photograph 10: WF11 (River Braan)</b> (example of a medium/large WFD water body)</p>	Water feature type: Major watercourse
	Catchment Area: 211.09km <sup>2</sup>
	WFD water body: River Braan Water body ID: 6576
	Key hydraulic connections: Sourced as the outlet of Loch Freuchie, the watercourse flows east through Strathbraan valley with multiple tributaries joining from uplands catchments in both north and south directions. The River Braan conflues with the River Tay on its south bank west of Little Dunkeld.
	Surrounding land use: Arable agricultural, rough pasture, mixed forestry, ancient woodland, road and rail infrastructure.
Description of Specific Baseline Conditions	
Flood Risk	
<p>WF11 (River Braan) flows in a generally north east direction and meets WF06 (River Tay) downstream of Inver in the study area and has a catchment area of 211km<sup>2</sup>. WF11 (River Braan) is crossed by the existing A9 between Little Dunkeld and Inver. WF11 (River Braan) passes in close proximity to Inver and Little Dunkeld. WF11 (River Braan) is part of the River Tay SAC.</p> <p>SEPA Flood Maps indicate fluvial flood risk from the 0.5% AEP (200-year) event to properties on the left bank of WF11 (River Braan), including the Old Inn, Ladeside Cottages, Inver Mill Farm and Inver Mill Caravan Site. On the right bank approximately 70 static caravans within Inver Mill Holiday Park are shown to be at risk. According to the SEPA Flood Maps, a section of the existing A9 of approximately 650m between the WF11 (River Braan) crossing and the WF12 (Mill Stream) crossing is located in the floodplain of the River Tay and River Braan. Most of this section would be overtopped in a 0.5% AEP (200-year) plus CC flood event.</p> <p>Baseline hydraulic modelling of the 0.5% AEP (200-year) plus CC flood event and the SEPA Flood Maps have similar flood extents in some areas, however there are areas where the flood extents differ:</p>	very high

<ul style="list-style-type: none"> <li>the model predicts overtopping on both banks of WF11 (River Braan) and WF12 (Mill Stream) upstream of the A9 WF11 (River Braan) crossing, with significant flood depths between 1.0-1.2m affecting up to 20-25 properties;</li> <li>the model predicts WF11 (River Braan) overtops the right bank and floods Inver Mill Caravan site, affecting 65-70 static caravans with depths between 1.5-3.6m, and inundates the unclassified road to Inver at the southern boundary of the caravan site;</li> <li>the model predicts the main channel of WF11 (River Braan) overtops the right bank near The Hermitage Junction; floodwater is predicted to flow south and pond against the Highland Main Line Railway embankment; and</li> <li>the model predicts floodwater from WF11 (River Braan) and WF12 (Mill Stream) will merge with floodwater from the River Tay, ponding against the A9 embankment and flooding the existing A9 carriageway over a length of several hundred meters to varying depths up to 0.6m.</li> </ul>	
<b>Hydromorphology</b>	
<p>SEPA Morphology status: High (2023 classification year).</p> <p>The watercourse displays a meandering planform and a predominantly single-thread channel with pool-riffle and uniform/rapid flow types. Bedforms comprise pools and riffles, and plane-riffles. The channel has numerous large pebble/cobble deposits throughout the study area including point bars, side bars and mid-channel bars (both vegetated and unvegetated).</p> <p>A combination of flow regulation and river training, such as reinforced embankments, and localised bank protection, have resulted in the river being confined primarily within a single-thread channel at the Braan bridge crossing. Given the discharge and energy of this river system, it retains the power to re-activate former river channels and adjust its course during high flow events.</p> <p>Existing pressures:</p> <ul style="list-style-type: none"> <li>diversion of flow from a weir feature upstream from Inver Bridge into the former WF12 (Mill Stream);</li> <li>gabion right bank reinforcement extending 400m from Inver Mill Farm caravan site to the existing A9 bridge crossing;</li> <li>WF11 (River Braan) is currently crossed by the existing A9 at Dunkeld by a single span bridge with concrete abutments. On the left bank, the existing bridge abutment is set back by approximately 10m, however on the right bank. The abutment is not set bank and extends to the bed of the watercourse and features a cantilevered footpath. Gabion baskets provide toe protection in front of the right bank abutment beneath the existing A9 bridge crossing and are showing signs of failure;</li> <li>Significant length of artificial bank comprising gabion baskets upstream of the bridge on the right bank, following the outside of a meander bend.</li> </ul>	very high
<b>Surface Water Quality</b>	
SEPA Physico-chemical/ Biological elements/ Specific pollutants status: High/ Good/ Pass (2023 classification year).	very high

<p>Low flow value (<math>Q_{95}</math>): 0.609m<sup>3</sup>/s</p> <p>WF11 (River Braan) is part of the River Tay SAC, designated primarily for Atlantic salmon; sea lamprey, brook lamprey, river lamprey and otter are also qualifying features of the site.</p> <p>Diffuse run-off may occur from land uses within the catchment. The majority of the catchment comprises of open moorland with rough grazing and farmland, which may be sources of high nutrient levels (nitrogen and phosphorous) from agricultural fertilizers as well as biological pollutants from rough grazing and farmland. Run-off from Forestry (~22%), ancient and historic woodland (~5%) within the catchment could include sediment, dissolved organic carbon and nutrients. Run-off from urban development (including the existing A9 and the Highland Main Line railway) includes suspended solids and contaminants bound to them (such as heavy metals and phosphorus); de-icing salt (chloride), oil and related compounds.</p> <p>Potential pollutants include:</p> <ul style="list-style-type: none"> <li>▪ PBTC-C25 Old Saw Mill and PBTC-C26 Old Corn Mill with potential for contaminants associated with historic activity – each 10m from watercourse; and</li> <li>▪ PBTC-C49 Depot and Storage Tank potential for contaminants associated with historic and current site activity – 20m from watercourse.</li> </ul> <p>Within the 500m study area, the following CAR Licences are associated with the watercourse:</p> <ul style="list-style-type: none"> <li>▪ Two point sources for engineering works associated with bank reinforcement.</li> </ul>	
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**Table A19.1-11: WF11A**

Overview	
 <p><b>Photograph 11: WF11A</b></p>	Water feature type: Drainage channel
	Catchment Area: 0.31km <sup>2</sup>
	Key hydraulic connections: Sourced within the WF11 (River Braan) catchment on the slopes of the Ladywell Plantation. The channel emerges south of the Highland Main Line railway, which it is then culverted under, reappearing in the woodland to the north of the line, then culverted under a local road, the reappears and enters WF11 (River Braan) at the east end of Inver Mill Holiday Park.
	Surrounding land use: Mixed forestry, mainly ancient, arable agriculture and road and rail infrastructure.
Description of Specific Baseline Conditions	
Flood Risk	
<p>This watercourse has a catchment area less than 3km<sup>2</sup> so is not included in the SEPA Flood Map.</p> <p>Inver Mill Holiday Park is located within 100m of the watercourse.</p> <p>This watercourse is situated outside the A9 scheme boundary and flooding from it does not impact on the project area. It has therefore not been assessed further on flood risk.</p>	low
Hydromorphology	
<p>SEPA Morphology status: not classified.</p> <p>The watercourse displays a low sinuosity planform with steep step-pool flow types in reaches downstream of the Highland Main Line railway. Bedforms comprise boulder steps and pools and boulder cascades on steeper gradients. Relict boulders provide bed and bank controls.</p> <p>Existing pressures:</p>	low

- culverted through a pipe culvert in the upper reaches of the Highland Main Line railway for approximately 35m, as suggested by a series of manholes observed; and
- culverted beneath the local access road to Inver for approximately 8m.

The watercourse cannot be assessed as “stable” under existing conditions, in that it has been so heavily modified and subjected ephemeral flow conditions that natural channel morphology criteria cannot be applied.

#### Surface Water Quality

SEPA Physico-chemical/ Biological elements/ Specific pollutants status: not classified.

Low flow value ( $Q_{95}$ ): 0.0014m<sup>3</sup>/s


Diffuse run-off may occur from land uses within the catchment. The majority of the catchment comprises of ancient and historic woodland (~60%) which may be sources of sediment, dissolved organic carbon and nutrients. Run-off from arable agriculture (~38%) within the catchment could include high nutrient levels (nitrogen and phosphorous) from agricultural fertilizers as well as biological pollutants from rough grazing and farmland. Run-off from urban development (~0.2%) (including the Highland Main Line railway) includes suspended solids and contaminants bound to them (such as heavy metals and phosphorus); de-icing salt (chloride), oil and related compounds.

Within the 500m study area, no CAR Licences are associated with the watercourse.

medium



**Table A19.1-12: WF12 (Mill Stream)**


Overview	
 <p><b>Photograph 12: WF12 (Mill Stream)</b></p>	Water feature type: Artificial watercourse
	Catchment Area: 0.02km <sup>2</sup>
	Key hydraulic connections: Artificial channel taking water from WF11 (River Braan) at Inver Mill, with large culverted sections, discharges into WF06 (River Tay) at NGR NO 01704 42329
	Surrounding land use: Urban, grassland, woodland, road infrastructure.
Description of Specific Baseline Conditions	
Flood Risk	
<p>WF12 (Mill Stream) flows from WF11 (River Braan) at NO 01573 42153 to WF06 (River Tay) at NO 01704 42329 through Inver in the study area. It has a small surface catchment of 0.02km<sup>2</sup> but any flooding along it originates from WF11 (River Braan) or WF06 (River Tay). WF12 (Mill Stream) is crossed by the existing A9 upstream of the WF11 (River Braan) crossing. WF12 (Mill Stream) is within close proximity to properties in Inver. WF12 (Mill Stream) flows into the River Tay SAC.</p> <p>This watercourse has a catchment area less than 3km<sup>2</sup> so is not included in the SEPA Flood Map, however the SEPA Flood Maps (2024b) do show the short section of approximately 650m from the WF11 (River Braan) crossing to the WF12 (Mill Stream) crossing that runs through the functional floodplain (area with greater than 0.5% probability of flooding in any year) of the River Tay and River Braan.</p> <p>WF12 (Mill Stream) has been included as a principal Stage 3 baseline hydraulic modelling of WF11 (River Braan) and WF06 (River Tay) for the 0.5% AEP (200-year) plus CC flood event includes WF12 (Mill Stream) and the model outputs and SEPA Flood Maps have similar flood extents in some areas, however there are areas where the flood extents differ:</p> <ul style="list-style-type: none"> <li>the model predicts overtopping on both banks of WF12 (Mill Stream) and WF11 (River Braan) upstream of the A9 WF11 crossing, with significant flood depths between 1.0-1.2m affecting up to 20-25 properties; and</li> </ul>	very high

<ul style="list-style-type: none"> <li>the model predicts floodwater from WF11 (River Braan) and WF12 (Mill Stream) will merge with floodwater from WF06 (River Tay), ponding against the A9 embankment and flooding the existing A9 carriageway over a length of several hundred meters to varying depths up to 0.6m.</li> </ul>	
<b>Hydromorphology</b>	
<p>SEPA Morphology status: not classified.</p> <p>The watercourse is an engineered channel and displays an artificial planform from the off-take of flow from a meander of WF11 (River Braan) approximately 145m upstream of the existing A9, plane bed uniform/tranquil to uniform/rapid flow types in upstream and downstream reaches. Bedforms comprise homogenous plane-bed features downstream of the mill lade and upstream of the existing A9 crossing. Relict boulders downstream of the mill lade provide bed and bank controls where the channel is not artificially confined with revetments.</p> <p>Existing pressures:</p> <ul style="list-style-type: none"> <li>masonry engineered channel for approximately 55m towards a historic mill;</li> <li>concrete chute approximately 20m long which carries flow to where the wheel for the mill would have been located;</li> <li>culverted beneath residential properties and local access roads for approximately 65m and the existing A9 for approximately 40m;</li> <li>flows through an artificially straightened channel with masonry left bank protection for approximately 100m behind residential gardens (Ladeside Cottages);</li> <li>artificially straightened channel with left bank masonry protection for approximately 100m upstream of A9 culvert; and</li> <li>masonry bed protection for approximately 5m upstream of the existing A9 culvert entrance to 20m downstream on the culvert apron, extending to the confluence with WF06 (River Tay).</li> </ul> <p>The watercourse cannot be assessed as “stable” under the existing conditions, in that it has been so heavily modified that it precludes applying “natural channel morphology” criteria.</p>	<p>low</p>
<b>Surface Water Quality</b>	
<p>SEPA Physico-chemical/ Biological elements/ Specific pollutants status: not classified.</p> <p>Low flow value (<math>Q_{95}</math>): 0.003m<sup>3</sup>/s</p> <p>Located upstream of the River Tay SAC, the watercourse itself is considered to exhibit ‘Poor’ ecosystem quality due to reduced connectivity to the wider catchment or a lack of resources to support fish species of conservation interest.</p>	<p>medium</p>

Diffuse run-off may occur from land uses surrounding WF12 (Mill Stream). The majority of the catchment comprises of urban development (~80%) (including the existing A9) which may be sources of suspended solids and contaminants bound to them (such as heavy metals and phosphorus); de-icing salt (chloride), oil and related compounds, with the rest of the catchment comprising of grassland, mainly improved, and woodland. Potential pollutants include:


- PBTC-C23 and PBTC-C25 Old Saw Mills, PBTC-C24 Old Smithy and PBTC-C26 Old Corn Mill with potential for contaminants associated with historic activity – each 10m from watercourse; and
- one point source from Sewage Treatment Works (STWs) discharge.

**Table A19.1-13: WF12A**

Overview	
 <p><b>Photograph 13: WF12A</b></p>	Water feature type: Drainage channel
	Catchment Area: 0.33km <sup>2</sup>
	Key hydraulic connections: Sourced in northern slopes of Craigvinean Forest. Watercourse flows east then south down to the A9, which it is culverted under to the north side of the Highland Main Line railway where it reappears and drains into the River Tay opposite Dunkeld House.
	Surrounding land use: Mixed woodland, ancient woodland, road and rail infrastructure.
Description of Specific Baseline Conditions	
Flood Risk	
<p>This watercourse has a catchment area less than 3km<sup>2</sup> so is not included in the SEPA Flood Map.</p> <p>The hydraulic assessment indicates that the watercourse is in-bank upstream of the A9 in the design 0.5% AEP (200-year) plus CC event. There is &gt;600mm freeboard to the A9 and therefore the flood risk is considered low.</p>	low
Hydromorphology	
<p>SEPA Morphology status: not classified.</p> <p>The watercourse displays a low sinuosity planform with steep step-pool and uniform rapid flow types. Bedforms comprise cobble steps and pools with and plane-bed features.</p> <p>Existing pressures:</p> <ul style="list-style-type: none"> <li>▪ culverted beneath the existing A9 and Highland Main Line railway for approximately 100m; and</li> <li>▪ lengths of bank and bed protection associated with culvert structures.</li> </ul> <p>The watercourse is stable under the existing conditions in that it appears to be competent to transport the water and sediment supplied from upstream without excessive erosion or deposition.</p>	medium

Surface Water Quality	
<p>SEPA Physico-chemical/ Biological elements/ Specific pollutants status: not classified.</p> <p>Low flow value (Q<sub>95</sub>): 0.0015m<sup>3</sup>/s</p> <p>Diffuse run-off may occur from land uses within the catchment. The majority of the catchment comprises of ancient and historic woodland (~90%) which may be sources of sediment, dissolved organic carbon and nutrients. Run-off from urban development (including the existing A9 and the Highland Main Line railway) includes suspended solids and contaminants bound to them (such as heavy metals and phosphorus); de-icing salt (chloride), oil and related compounds.</p> <p>Within the 500m study area, no CAR Licences are associated with the watercourse.</p>	medium


**Table A19.1-14: WF12B**

Overview	
 <p><b>Photograph 14: WF12B</b></p>	Water feature type: Drainage channel
	Catchment Area: 0.36km <sup>2</sup>
	Key hydraulic connections: Sourced on the eastern slopes north of Craig Vinean. Channel occurs less than 30m west from the A9, which it is culverted under to the north side of the Highland Main Line railway where it reappears and drains into the River Tay.
	Surrounding land use: Mixed forestry, ancient woodland, road and rail infrastructure.
Description of Specific Baseline Conditions	
Flood Risk	
<p>This watercourse has a catchment area less than 3km<sup>2</sup> so is not included in the SEPA Flood Map.</p> <p>The watercourse crosses the A9 where the road is in cutting. Upstream of the A9 the watercourse cross section is above the existing road level. A hydraulic assessment of the existing A9 culvert during the 0.5% AEP (200-year) plus CC flood event indicates that the headwater level is above the culvert soffit and the watercourse is therefore at risk of flooding the existing A9.</p>	very high
Hydromorphology	
<p>SEPA Morphology status: not classified.</p> <p>The watercourse displays a low sinuosity planform with plane-bed features and is dominated by storm-generated overland flow forming a poorly-defined channel upstream from the A9, with uniform tranquil flow types in downstream reaches.</p> <p>Existing pressures:</p> <ul style="list-style-type: none"> <li>conveyed beneath the existing A9 and Highland Main Line railway for approximately 80m;</li> <li>lengths of bank and bed protection associated with culvert structures; and</li> <li>small wooden bridge crosses WF12B to allow the public footpath along the banks of the River Tay to continue.</li> </ul>	low

The watercourse cannot be assessed as “stable” under existing conditions, in that it has been so heavily modified and subjected ephemeral flow conditions that natural channel morphology criteria cannot be applied.	
<b>Surface Water Quality</b>	
<p>SEPA Physico-chemical/ Biological elements/ Specific pollutants status: not classified.</p> <p>Low flow value (<math>Q_{95}</math>): 0.0016m<sup>3</sup>/s</p> <p>Diffuse run-off may occur from land uses within the catchment. The majority of the catchment comprises of ancient and historic woodland (~90%) which may be sources of sediment, dissolved organic carbon and nutrients. Run-off from urban development (including the existing A9 and the Highland Main Line railway) includes suspended solids and contaminants bound to them (such as heavy metals and phosphorus); de-icing salt (chloride), oil and related compounds.</p> <p>Within the 500m study area, no CAR Licences are associated with the watercourse.</p>	medium




**Table A19.1-15: WF13**

Overview	
 <p><b>Photograph 15: WF13 – upstream view towards existing A9 culvert outlet (typical example of a small water feature)</b></p>	Water feature type: Minor watercourse
	Catchment Area: 0.97km <sup>2</sup>
	Key hydraulic connections: Sourced on the slopes west of Inver Wood, surrounding Creag Bheag. The water feature comprises of two channels that flow east and meet ~300m west of the A9, then flow as a single channel down to the A9, which it is culverted under to the north side of the Highland Main Line railway where it reappears and drains into the River Tay.
	Surrounding land use: Mixed forestry, ancient woodland, rough grazing, arable agricultural, road and rail infrastructure.
Description of Specific Baseline Conditions	
Flood Risk	
<p>This watercourse has a catchment area less than 3km<sup>2</sup> so is not included in the SEPA Flood Map.</p> <p>The hydraulic assessment indicates that the watercourse is out of bank upstream of the A9 in the design 0.5% AEP (200-year) plus CC event, however there is &gt;600mm freeboard to the A9 and therefore the flood risk is considered low.</p>	low
Hydromorphology	
<p>SEPA Morphology status: not classified.</p> <p>The watercourse displays a low sinuosity planform with step-pool and pool – riffle bedforms and flow types and plane bed features. Mid channel and point bars were noted. Relict boulders and trees provide bank controls where the channel is not artificially confined.</p> <p>Existing pressures:</p> <ul style="list-style-type: none"> <li>conveyed beneath the Old Military Road and local access track for approximately 6m by a stone arch culvert;</li> </ul>	high



<ul style="list-style-type: none"> <li>▪ culverted beneath the existing A9 for approximately 45m;</li> <li>▪ conveyed below the Highland Main Line railway through a for approximately 12m masonry arch bridge; and</li> <li>▪ bank and bed protection associated with existing structures.</li> </ul> <p>The watercourse is stable under the existing conditions, in that it appears to be competent to transport the water and sediment supplied from upstream without excessive erosion or deposition.</p>	
<b>Surface Water Quality</b>	
<p>SEPA Physico-chemical/ Biological elements/ Specific pollutants status: not classified.</p> <p>Low flow value (<math>Q_{95}</math>): 0.0043m<sup>3</sup>/s</p> <p>Located upstream of the River Tay SAC but the watercourse itself is considered to exhibit 'Moderate' ecosystem quality as conditions present are suitable for supporting a range of aquatic ecology including macroinvertebrates and macrophytes species.</p> <p>Diffuse run-off may occur from land uses within the catchment. The majority of the catchment comprises of ancient and historic woodland (~68%) which may be sources of sediment, dissolved organic carbon and nutrients. Run-off from urban development (including the existing A9 and the Highland Main Line railway) includes suspended solids and contaminants bound to them (such as heavy metals and phosphorus); de-icing salt (chloride), oil and related compounds.</p> <p>Within the 500m study area, no CAR Licences are associated with the watercourse.</p>	medium

**Table A19.1-16: WF14**

Overview		
 <p><b>Photograph 16: WF14</b></p>	Water feature type: Minor watercourse	
	Catchment Area: 0.64km <sup>2</sup>	
	Key hydraulic connections: Sourced on the slopes between Creag an Eunaich and Creag Bheag. Channel flows north-east past Newton Craig, down to local roads west of the A9, which it passes under through structures, including the Highland Main Line railway and the A9, then drains into the River Tay where the A9 crosses the River Tay.	
	Surrounding land use: Mixed forestry, ancient woodland, road and rail infrastructure.	
Description of Specific Baseline Conditions		Importance
Flood Risk		
<p>This watercourse has a catchment area less than 3km<sup>2</sup> so is not included in the SEPA Flood Map. The watercourse crosses under the B898 through a masonry culvert (Crossing 14A). Downstream of this, it passes under the A9 Tay bridge where the bridge deck is several metres above the river level. The risk of flooding to the A9 is therefore negligible.</p> <p>The hydraulic assessment indicates that the watercourse is out of bank upstream of the B898 in the design 0.5% AEP (200-year) plus CC event. However, there is &gt;600mm freeboard to the A9 and therefore the flood risk to the B898 is considered low.</p>		low
Hydromorphology		
<p>SEPA Morphology status: not classified.</p> <p>The watercourse displays a low sinuosity planform with steep step-pool and uniform/tranquil flow types in the downstream reach. Bedforms comprise boulder steps and pools with plane-riffle and plane-bed features. Bed armor appears to be static and occasional alternate bars were seen along the watercourse.</p> <p>Existing pressures:</p>		medium

- conveyed through two 8m long pipe culverts under local footpaths: one upstream of Newton Craig and also through forestry tracks upstream of the B898;
  - conveyed through a concrete pipe culvert beneath the B898 for 20m (the culvert soffit height measured 1.1m whilst the culvert height is 2.2m and the culvert wing walls and apron extend for 1.2m);
  - culverted beneath the Highland Main Line railway, downstream of the B898, via a masonry arch culvert with associated mammal ledge (the culvert extends for approximately 10m and paved reinforcement extends 16m along the right bank of WF14 and through the brick arch culvert); and
  - watercourse passes under Inver Bridge, downstream of the masonry arch culvert below the Highland Main Line railway, and discharges into WF06 (River Tay). Right bank protection was observed to extend downstream of the masonry arch culvert prior to Inver bridge.
- The watercourse is stable under the existing conditions, in that it appears to be competent to transport the water and sediment supplied from upstream without excessive erosion or deposition.

#### Surface Water Quality

SEPA Physico-chemical/ Biological elements/ Specific pollutants status: not classified.

Low flow value ( $Q_{95}$ ): 0.0029m<sup>3</sup>/s


Located upstream of the River Tay SAC but the watercourse itself is considered to exhibit 'Moderate' ecosystem quality as conditions present are suitable for supporting a range of aquatic ecology including macroinvertebrates and macrophytes species.

Diffuse run-off may occur from land uses within the WF14 catchment. The majority of the catchment comprises of ancient and historic woodland (~67%) and other forestry (~30%) which may be sources of sediment, dissolved organic carbon and nutrients. Run-off from urban development (including the existing A9 and the Highland Main Line railway) includes suspended solids and contaminants bound to them (such as heavy metals and phosphorus); de-icing salt (chloride), oil and related compounds.

Within the 500m study area, no CAR Licences are associated with the watercourse.

medium

**Table A19.1-17: WF16**

Overview	
 <p><b>Photograph 17: WF16</b></p>	Water feature type: Minor watercourse
	Catchment Area: 0.29km <sup>2</sup>
	Key hydraulic connections: Sourced on western slope of Craig a Barns. Channel flows west, down to a local road east of the A9, which it passes under through structures, then continues east under the A9 and a local access, then drains into the River Tay.
	Surrounding land use: Mixed forestry, ancient woodland and road infrastructure.
Description of Specific Baseline Conditions	
Flood Risk	
<p>The catchment area is less than 3km<sup>2</sup> therefore is not shown on SEPA flood mapping.</p> <p>The hydraulic assessment indicates that the watercourse is in bank in the design 0.5% AEP (200-year) plus CC event. The A9 culvert capacity is greater than the 0.5% AEP (200-year) plus CC peak flow and there is a &gt;600mm freeboard to the A9, therefore the flood risk is considered to be low.</p> <p>The watercourse flows through an area of ancient woodland upstream of the A9 with hydrological low importance to the woodland. There are no other receptors within the vicinity of the watercourse and therefore the sensitivity is considered to be low.</p>	low
Hydromorphology	
<p>SEPA Morphology: not classified.</p> <p>The watercourse displays a low sinuosity planform with steep step-pool and uniform rapid flow types in upstream reaches where the channel is not heavily modified. Bedforms comprise boulder steps and pools upstream and downstream of the existing A9. Bed material comprises relic boulders, cobbles gravel and silt. Relic boulders provide natural bed and bank controls where the channel is not artificially modified.</p>	medium

Existing pressures include:

- culverted upstream of the existing A9 carriageway below Kings Pass through a 6m long Brick arch culvert;
- culverted below the existing A9 for approximately 44m via a 0.90m concrete pipe culvert;
- lengths of bank and bed protection associated with culvert structures including approximately 12m of concrete bed reinforcement upstream of the existing A9 culvert;
- engineered cascades with masonry reinforced walls extending 25m upstream of the afore mentioned bank protection;
- masonry bed and bank protection extending 2.5m downstream of existing A9 culvert outlet; and
- culverted downstream of the existing A9 below General Wade's Military Road for approximately 10m through a 1.7m high stone arch culvert.

The watercourse appears stable under the existing conditions and artificial constraints. However, there is little evidence to suggest that coarse sediment is being transported from upstream reaches to step-pool reaches downstream from the A9. Site observations indicate that this is likely to result from a combination of factors which may include: ephemeral flow regime, scarce sediment supply and constraints from existing culverts and concrete cascade steps upstream of the A9.

#### Surface Water Quality

SEPA Physico-chemical/ Biological elements/ Specific pollutants status: not classified.


Low flow value ( $Q_{95}$ ): 0.0013m<sup>3</sup>/s

Diffuse run-off may occur from land uses within the catchment. The majority of the catchment comprises of ancient and historic woodland (~93%) which may be sources of sediment, dissolved organic carbon and nutrients. Run-off from urban development from the existing A9, includes suspended solids and contaminants bound to them (such as heavy metals and phosphorus); de-icing salt (chloride), oil and related compounds.

Within the 500m study area, no CAR Licences are associated with the watercourse.

medium

**Table A19.1-17: WF18**


Overview	
 <p><b>Photograph 17: WF18</b></p>	Water feature type: Minor watercourse
	Catchment Area: 0.17km <sup>2</sup>
	Key hydraulic connections: Sourced on western slope of Craig a Barns. Channel flows west, down to a local road east of the A9, which it passes under through structures, then continues east under the A9 and a local access, then drains into the River Tay.
	Surrounding land use: Mixed forestry, ancient woodland and road infrastructure.
Description of Specific Baseline Conditions	
Flood Risk	
<p>The catchment area is less than 3km<sup>2</sup> therefore is not shown on SEPA flood mapping.</p> <p>The hydraulic assessment indicates that the watercourse is in bank and below the A9 road level in the design 0.5% AEP (200-year) plus CC event. However, the A9 culvert capacity is greater than the 0.5% AEP (200-year) plus CC peak flow and there is a &gt;600mm freeboard to the A9, therefore the flood risk is considered to be low.</p> <p>The watercourse flows through an area of ancient woodland upstream of the A9 with hydrological low importance to the woodland. There are no other receptors within the vicinity of the watercourse and therefore the sensitivity is considered to be low.</p>	low
Hydromorphology	
<p>SEPA Morphology: not classified.</p> <p>The watercourse displays a low sinuosity planform with steep step-pool and uniform rapid flow types in upstream reaches where the channel is not heavily modified. Bedforms comprise boulder steps and pools upstream and downstream of the existing A9. Bed material comprises relic boulders, cobbles gravel and silt. Relic boulders provide natural bed and bank controls where the channel is not artificially modified.</p>	medium



<p>Existing pressures include:</p> <ul style="list-style-type: none"> <li>■ culverted below General Wade's Military Road through a 8m long masonry arch culvert with masonry walls extending for approximately 2m upstream;</li> <li>■ culverted below the existing A9 and local access track for approximately 75m via a 0.77m concrete pipe culvert with a trash screen at the inlet; and</li> <li>■ lengths of bed protection associated with culvert structures including approximately 4m of blockwork reinforcement downstream of the existing A9 and local access track culvert.</li> </ul> <p>The watercourse appears stable under the existing conditions and artificial constraints in that it appears to be competent to transport the water and sediment supplied from upstream without excessive erosion or deposition.</p>	
<b>Surface Water Quality</b>	
<p>SEPA Physico-chemical/ Biological elements/ Specific pollutants status: not classified.</p> <p>Low flow value (<math>Q_{95}</math>): 0.0008m<sup>3</sup>/s</p> <p>Diffuse run-off may occur from land uses within the catchment. The majority of the catchment comprises of ancient and historic woodland (~93%) which may be sources of sediment, dissolved organic carbon and nutrients. Run-off from urban development from the existing A9, includes suspended solids and contaminants bound to them (such as heavy metals and phosphorus); de-icing salt (chloride), oil and related compounds.</p> <p>Within the 500m study area, no CAR Licences are associated with the watercourse.</p>	<p>low</p>




**Table A19.1-18: WF186**

Overview	
 <p><b>Photograph 18: WF186</b></p>	Water feature type: Drainage channel
	Catchment Area: 0.05km <sup>2</sup>
	Key hydraulic connections: Channel runs through woodland from Larachmhor cottage to Craigmore cottage.
	Surrounding land use: Ancient woodland, urban.
Description of Specific Baseline Conditions	
Flood Risk	
<p>This watercourse has a catchment area less than 3km<sup>2</sup> so is not included in the SEPA Flood Map.</p> <p>This short (112m) ditch dug broadly along a contour does not appear to have an outlet and no significant impact on the conveyance route of the catchment runoff it intercepts. The ditch may have been dug to reduce the risk of flooding from surface runoff from the steep hillside to the cottages situated downslope and may provide minor storage (flood attenuation) and encourage infiltration into the ground. Multiple properties are located within 100m of the watercourse at Birnam Glen. The water feature is not a source of flood risk to the scheme.</p>	low
Hydromorphology	
<p>SEPA Morphology status: not classified.</p> <p>The watercourse displays a low sinuosity planform with steep step-pool and uniform tranquil flow types in upstream reaches. Bedforms comprise boulder steps and pools with plane-bed features on shallower gradients. Relic boulders which provide frequent bed and bank controls where the channel is not artificially confined. Evidence of localised berm formation upstream (~0.45m wide) suggests a recovery in sinuosity. Flow appears to discharge to ground upon reaching the Highland Main Line railway where there was no evidence of a culvert with no obvious hydrological connection to the existing A9 or the River Tay.</p> <p>Existing pressures:</p>	low

<ul style="list-style-type: none"> <li>▪ culverted below a local access road from Craigbeithe for approximately 3.5m; and</li> <li>▪ confined by a masonry stone wall, upon exit from the culvert, for approximately 15m on the left bank and 7m on the right bank.</li> </ul> <p>The watercourse cannot be assessed as “stable” under the current conditions in that it has been so heavily modified and subjected to ephemeral flow conditions that natural channel morphology criteria cannot be applied. However, no evidence of excessive erosion or deposition was noted.</p>	
<b>Surface Water Quality</b>	
<p>SEPA Physico-chemical/ Biological elements/ Specific pollutants status: not classified.</p> <p>Low flow value (<math>Q_{95}</math>): not applicable, artificial drainage channels.</p> <p>Diffuse run-off may occur from land uses within the catchment. The majority of the catchment comprises of ancient and historic woodland which may be sources of sediment, dissolved organic carbon and nutrients. Run-off from urban development includes suspended solids and contaminants bound to them (such as heavy metals and phosphorus); de-icing salt (chloride), oil and related compounds.</p> <p>Within the 500m study area, no CAR Licences are associated with the watercourse.</p>	low

**Table A19.1-18: WF187**

Overview	
 <p><b>Photograph 19: WF187</b></p>	Water feature type: artificial drainage channels and ponds
	Catchment Area: N/A
	Key hydraulic connections:
	Surrounding land use: Landfill site, mixed woodland, urban.
Description of Specific Baseline Conditions	
Flood Risk	
These water features have a catchment area less than 3km <sup>2</sup> so is not included in the SEPA Flood Map. Small surface drains and ponds associated with Ladywell Landfill that do not drain to the A9. There is therefore no flood risk anticipated.	low
Hydromorphology	
WFD hydromorphology status: not classified. Trapezoidal drainage ditches associated with Ladywell Landfill, which display no clear hydrological connection to the existing A9 or the proposed scheme. As WF187 is an artificial land drain it displays no natural channel morphology or flow types and is likely ephemeral.	low
Surface Water Quality	
SEPA Physico-chemical/ Biological elements/ Specific pollutants status: not classified. Low flow value (Q <sub>95</sub> ): not applicable, artificial drainage channels. Diffuse run-off may occur from land uses within the catchment. The majority of the catchment comprises of the Ladywell Landfill site, and may contain sources of contaminants associated with present use and its historic use as a quarry. Within the 500m study area, no CAR Licences are associated with the watercourse.	low

## 1.2 References

SEPA (2024a). Flood maps. Available at:

<https://www.sepa.org.uk/environment/water/flooding/flood-maps/> (Accessed October 2024).

SEPA (2025). SEPA Water Classification Hub. Available at: <https://www.sepa.org.uk/data-visualisation/water-classification-hub/> (Accessed February 2025).

SSE Renewables (2021). Tummel Valley hydro scheme. Available at:

<https://www.sserenewables.com/hydro/tummel-valley/> (Accessed October 2024).