13 Road Drainage and the Water Environment

This chapter assesses the potential impacts of the proposed Scheme on the water environment, comprising surface water hydrology, flood risk, fluvial geomorphology and water quality, and identifies measures for mitigating these impacts.

For fluvial geomorphology and water quality, the study area was defined as the proposed Scheme footprint plus a 500m buffer around it. The study area for hydrology and flood risk was based on a conceptual understating of the likely propagation of impacts. The baseline conditions were informed by consultation, desk-based assessments, site walkover and topographic survey. Hydraulic modelling of five areas, was undertaken to assess the capacity of the existing crossings structures on the proposed Scheme and also to assess potential flood risk. The Highways Agency Water Risk Assessment Tool (HAWRAT) has been used to determine impacts on surface water features (SWFs) from route runoff and spillage risk.

There are several environmentally sensitive SWFs within the study area. The largest SWF in the study area, the River Nairn, and two of its tributaries are Protected Areas for Freshwater Fish under the Water Framework Directive. Within the study area, a number of SWFs to the east and south-east of Nairn form tributaries to the River Nairn. In addition, a number of SWFs to the west of Nairn flow into the Moray Firth, which is designated as a Ramsar site, Special Area of Conservation, Special Protection Area and Site of Special Scientific Interest.

All potential impacts before mitigation are shown in full in this chapter. The potential residual impacts are presented in Appendix A13.4 (Residual Impact Tables (Road Drainage and the Water Environment)) and summarised in Section 13.10 (Summary).

The results of the HAWRAT routine runoff assessments and HAWRAT spillage risk assessments are summarised in this chapter. The parameters and detailed results are presented within Appendix 13.3 (Water Quality Calculations).

Before mitigation, a number of potential impacts on SWFs of Moderate significance or above were identified as a result of construction and operation of the proposed Scheme. These include impacts on flood risk/hydrology, fluvial geomorphology, water quality/supply, dilution and removal of waste products and biodiversity.

Mitigation during construction will include adherence to relevant SEPA Pollution Prevention Guidelines (PPGs). Watercourse realignments would be sensitively designed as mitigation to create a sinuous low flow channel with a sinuous planform, varied bank profiles and natural substrate, where practicable. The watercourses realignments would be designed to prevent deposition of fine sediment and/or cause scour issues. With the implementation of the proposed mitigation during construction, residual impacts on the majority of surface water features would be reduced to Slight or Negligible significance. However, impacts on the attribute 'biodiversity' have the potential to be of Moderate adverse significance for SWF 03, SWF 24 and SWF 26. This significance is due in part to the importance of this attribute for these SWFs (very high importance because Protected Area for Freshwater Fish or presence of internationally important fish species). These impacts would be temporary and would are reflective of the level of risk of a pollution incident with mitigation in place.

Mitigation for the operational phase will include use of Sustainable Drainage Systems e.g. Basin and Pond (hereafter referred to as SUDS) to protect receiving waterbodies and inclusion of agricultural land within the CPO to provide compensatory storage areas to accommodate water during a flood event where the proposed Scheme encroaches into areas identified as part of existing floodplains. With the proposed mitigation, the vast majority of residual impacts during operation would be reduced to Neutral, with a small number of Slight significance impacts.

13.1 Introduction

13.1.1 This chapter presents the results of the Design Manual for Roads and Bridges (DMRB) Stage 3 Environmental Impact Assessment (EIA) for the A96 Dualling Inverness to Nairn (including Nairn Bypass) scheme (hereafter referred to as the proposed Scheme) in relation to impacts on the surface water environment.

13.1.2 Water is a resource that is essential to all animal and plant life. It is also necessary for industry, agriculture, waste disposal, many forms of transport, recreation and sport. The maintenance and improvement of the quality of our drinking water, watercourses, groundwater resources and coastal waters is central to UK Government and European policy. Road schemes may affect the water environment by impacting on the quality of water bodies and the existing hydrology of the catchments through which roads pass.

13.1.3 During construction, the principal risks to the water environment relate to suspended sediments contained in runoff from the site, airborne dust and accidental spillage of fuel, oil or other chemicals used on site. Construction work can also create new pathways by which pollution can reach surface water or groundwater. Once a road is in use, the principal areas of concern arise from pollutants washed from the road surface by rainwater, and spillages of fuel or other contaminants as a result of road traffic accidents. Creation of new roads can also affect flood risk due to increased areas of impermeable surfaces (which increases the rate of run-off during rainfall), loss of floodplain capacity, or the obstruction of overland flows.

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

- Appendix A13.1 (Baseline Conditions);
- Appendix A13.2 (Flood Risk Assessment);
- Appendix A13.3 (Water Quality Calculations);
- Appendix A13.4 (Residual Impact Tables (Road Drainage and the Water Environment));
- Appendix A13.5 (Watercourse Crossings); and
- Figure 13.1 (Features of the Water Environment).

13.1.5 In addition, drawings showing the proposed drainage strategy, including the location of the proposed outfalls, can be found in Chapter 4 (Engineering Assessment) of the DMRB Stage 3 Scheme Assessment Report (drawing numbers B2103500-HW-0100-SK-137 and B2103500-HW-0100-SK-138).

13.1.6 The assessment of road drainage and the water environment includes surface water hydrology, flood risk, fluvial geomorphology and water quality. A summary of the assessment for each of these disciplines is provided in Section 13.3 (Methodology).

13.1.7 This chapter sets out the assessment methods, Section 13.3 (Methodology), describes the baseline conditions, Section 13.4 (Baseline Conditions), and identifies potential impacts that could occur in the absence of mitigation, Section 13.6 (Impacts – Construction) and Section 13.7 (Impacts – Operation). Mitigation to avoid, reduce or offset the potential impacts is then described in Section 13.8 (Mitigation) and residual impacts following implementation of this mitigation are then identified in Section 13.9 (Residual Impacts).

13.1.8 Further considerations related to the road drainage and the water environment assessment are addressed separately within the following chapters:

- potential impacts on groundwater and geomorphology, in the context of groundwater quality, solid and drift geology and the potential indirect impact on surface water features (SWFs) (via groundwater dewatering) (Chapter 12: Geology, Soils, Contaminated Land and Groundwater); and
- potential impacts on ecological receptors as a result of the changes to the surface water environment (Chapter 11: Habitats and Biodiversity).

13.2 Legislative and Policy Background

13.2.1 Appendix A18.1 (Planning Policy Context for Environmental Assessment) describes the planning policies and guidance from national to local level which are relevant to road drainage and the water environment. An assessment of the compliance of the proposed Scheme against all development plan policies relevant to this environmental topic is reported in Appendix A18.2 (Assessment of Development Plan Policy Compliance) and a summary overview is provided in Section 18.4 (Assessment of Compliance) in Chapter 18 (Policies and Plans).

Water Framework Directive (WFD)

13.2.2 The Water Framework Directive (WFD), which is transposed into Scottish law by the 'Water Environment and Water Services (Scotland) Act 2003' (WEWS Act), sets targets for restoring and improving the ecological status of water bodies. Under the WFD, the status of water is assessed using a range of quality indicators (physico-chemical, biological and hydromorphological) to give a holistic assessment of aquatic ecological health. The objectives of the WFD are for all water bodies to achieve or maintain an overall status of 'good' by 2021 or over agreed timescales, up to or beyond 2027. Artificial or heavily modified water bodies have less stringent targets to meet, however, these water bodies need to achieve at least 'good ecological potential' over the same timescales.

13.2.3 The WFD includes five quality classes (High, Good, Moderate, Poor and Bad) and establishes a requirement to identify and monitor a range of existing pressures on water bodies which may threaten the objectives of the WFD. These pressures are generally anthropogenic and may include point source discharges, abstractions and morphological alterations such as culverts, impoundments and channel straightening. To help fulfil WFD aims, a new planning process called river basin planning has also been implemented, involving the production of a River Basin Management Plan (RBMP) for the Scotland river basin district and supplementary Area Management Plans outlining how the water environment would be managed and improved to meet WFD objectives over time. Consideration has been given to the requirements of Directive 2000/60/EC on establishing a framework for the Community action in the field of water policy (The Water Framework Directive) during assessment of the importance of watercourses and selection of mitigation measures.

Controlled Activities Regulations (CAR)

13.2.4 The WEWS Act gives Scottish Ministers power to regulate activities in the water environment. This is achieved under The Water Environment (Controlled Activities) (Scotland) Regulations 2011 (CAR). This legislation controls engineering works within inland surface waters, as well as point source discharges, abstractions and impoundments. There are three different levels of authorisation under CAR: General Binding Rules (GBR), Registration and Licence (either Simple or Complex). The level of regulation increases as the risk from the activity being undertaken increases with regard to the integrity and status of the water environment. The level of authorisation under CAR for the proposed scheme will depend on the specific activities involved, however, is likely to range from GBRs covering short road drainage discharges, to Simple Licences for longer road drainage discharges (draining over 1km in length), as well as larger water feature crossings and realignments. Activities requiring CAR authorisation are required to be approved by SEPA prior to the start of construction.

Planning Policy

13.2.5 Appendix A18.1 (Planning Policy Context for Environmental Assessment) describes the planning policies and guidance from national to local level which are relevant to Road Drainage and the Water Environment. An assessment of the compliance of the proposed Scheme against all development plan policies relevant to this environmental topic is reported in Appendix A18.2 (Assessment of Development Plan Policy Compliance) and a summary overview is provided in Section 18.4 (Assessment of Compliance) in Chapter 18 (Policies and Plans).

13.3 Methodology

13.3.1 The assessment has taken into account relevant Design Manual for Roads and Bridges (DMRB) guidance, legislation and regulations, including those listed below. The DMRB does not provide a methodology for fluvial geomorphology assessment and best practice guidance was applied, as listed below:

- River Geomorphology: A Practical Guide (Environment Agency (EA) 1998);
- WFD policy guidance ‘The Future for Scotland’s Waters, Guiding Principles on the Technical Requirements of the Water Framework Directive’ (SEPA 2002);
- High Review of Impact Assessment Tools and Post Project Monitoring Guidelines (Haycocks Associates 2005);
- DMRB Volume 11, Section 3, Part 10, HD45/09 Road Drainage and the Water Environment (Highways Agency, Transport Scotland, Welsh Assembly Government and The Department for Regional Development Northern Ireland 2009) (hereafter DMRB HD45/09);
- The Climate Change (Scotland) Act 2009;
- The Flood Risk Management (Scotland) Act 2009;
- The Water Environment (Controlled Activities) (Scotland) Regulations 2011 (as amended): A Practical Guide (SEPA 2011d);

- Scottish Planning Policy (SPP) (Scottish Government 2014); and
- Technical Flood Risk Guidance for Stakeholders (SEPA 2014).

Approach to the Assessment

13.3.2 The assessment of impacts on attributes of the surface water environment in this chapter includes:

- Hydrology and Flood Risk: the assessment of potential impacts on the flow of water on or near the land surface, which is intrinsically linked to hydrogeology, water quality, geomorphology and ecology. Flood risk includes risk from all potential sources of flooding, including from rivers and the sea, surface water, groundwater, sewers and the failure of water management infrastructure and drainage systems.

  There is a possibility for new developments to be at risk of flooding from the aforementioned sources. In addition, developments have the potential to increase flood risk elsewhere, including as a result of the loss of flood plain storage and through the increased amount of surface water runoff generated by the site. Therefore, an assessment of flood risk is fundamental to the planning process as it aims to prevent and reduce the risk of flooding to new developments and to ensure that the development does not increase flood risk in other areas.

  As set out in the SPP (Scottish Government 2014), a Flood Risk Assessment (FRA) is required where the development may be at 'medium to high risk' of flooding. This means where there is a 1 in 200 (0.5%) annual probability of flooding in any given year, or greater. The FRA undertaken during the development of the A96 Dualling Inverness to Nairn (including Nairn Bypass) forms a standalone document included as Appendix A13.2 (Flood Risk Assessment); however, key findings are summarised in this chapter.

- Fluvial Geomorphology: the assessment of landforms associated with fluvial processes and sediment dynamics in river environments. Fluvial Geomorphology is intrinsically linked to hydrogeology, water quality, hydrology and ecology. Various factors have been assessed during the geomorphological assessment including flow dynamics, the structure and material of the bed and banks, lateral and longitudinal connectivity, erosional and depositional features, the structure of the riparian zone and anthropogenic impacts (e.g. structures).

  For WFD compliance, consideration has been given to the requirements of the WFD during assessment of the importance of watercourses and selection of mitigation measures. Compliance with WFD objectives is ensured through the CAR licence process (paragraph 13.2.4).

- Water Quality: the assessment of potential impacts on various water quality attributes, such as water quality/supply, dilution and removal of waste products and biodiversity.

Study Area

Hydrology and Flood Risk

13.3.3 The study area for flood risk principally comprises the land adjacent to the proposed Scheme; however, the impacts of the proposed Scheme on flood risk may be felt a significant distance away from the proposed Scheme itself. Consequently, the study area extends to include all areas where flood risk is altered as a result of the proposed works associated with the proposed Scheme. This would include any watercourse, surface water and groundwater catchments that may be impacted due to the proposed Scheme. This results in an irregularly shaped study area for hydrology and flood risk.

Fluvial Geomorphology

13.3.4 The fluvial geomorphology study area captures all watercourses crossed by the proposed Scheme, extending 500m upstream and downstream. This buffer ensures that potential geomorphological features both at the watercourse crossing and a suitable distance upstream and downstream of the watercourse crossing is captured. The study areas may be extended for some watercourses as required (based on professional judgement). For example, the study area is extended to 1km upstream and downstream of the proposed Scheme for WFD designated water bodies.

Water Quality

13.3.5 The study area for water quality extends to a radius of at least 500m around the proposed Scheme; however, for some categories of data, the search may extend to significantly greater distances, depending on the location of features such as water quality sampling stations or protected areas (study area extended to 1km downstream for protected areas).

Determination of Baseline Conditions

13.3.6 Baseline conditions were identified through a combination of consultation, desk-based assessment, topographic surveys and site walkovers.

Desk-based Assessment

13.3.7 Data was collated from the following sources:

- 1:25,000 Ordnance Survey (OS) maps;
- observations made by Jacobs' hydrologists and geomorphologists during various site walkovers;
- Flood Maps (SEPA 2015a);
- RBMP Interactive Map (SEPA 2015b);
- Scotland's Environment Interactive Water Map (SEPA 2015c);
- Historic Maps of rivers for Scotland (National Library of Scotland 2016);
- SEPA river gauging data records from station 7004 (River Nairn at Firhall) and associated hydrometric data (SEPA 2016b);
- National River Flow Archive data (Centre for Ecology and Hydrology (CEH 2016b);
- Flood Estimation Handbook (FEH) Web Service. (CEH 2016a);
- Control of Pollution from Highway Drainage Discharges, Report (CIRIA 1997);
- flood incidents and extent data from Jacobs Stakeholder Consultation records;
- Low Flow Enterprise (LFE) flow duration curve percentiles supplied by Wallingford Hydro Solutions (2016);
- Envirocheck Report (Landmark 2006 and 2009);
- Flood Estimation Handbook CD-ROMv3 (CEH 2009);
- A96 Inshes to Nairn DMRB Stage 2 Assessment Scoping Study (Jacobs 2011);
- A96 Dualling Inverness to Nairn (including Nairn Bypass): DMRB Stage 2 Scheme Assessment Report (Jacobs 2014);
- A96 Dualling Inverness to Aberdeen Strategic Flood Risk Assessment (SFRA) (CH2M 2015a);
- A96 Dualling Inverness to Aberdeen Preliminary Engineering Assessment (Jacobs 2015a);
- A96 Dualling Inverness to Aberdeen Strategic Environmental Assessment – Tier 2 Environmental Report (CH2M 2015b);
- A96 Dualling Inverness to Nairn (including Nairn Bypass): DMRB Stage 3 Environmental Impact Assessment Screening and Scoping Report (Jacobs 2015b); and
- CAR, Pollution Prevention and Control (PPC) and Waste Management Licence (WML) data (SEPA 2016).

Site Walkovers and Surveys

13.3.8 Site walkovers/surveys were undertaken from 21 to 25 September 2015 by the hydrology team in order to gain a better understanding of the watercourses/water features which would potentially be impacted by the proposed Scheme.

13.3.9 A geomorphological walkover survey of the study area was undertaken between 28 September and 2 October 2015 to visually inspect SWFs in order to gain an understanding of the local topography, hydrological and sediment regime, and to gather field data for the water quality and geomorphology assessments.

13.3.10 Information obtained during the site walkovers/surveys has been incorporated into the baseline and impact assessment.

Findings of the Ground Investigation

13.3.11 Ground Investigations (GI) have been undertaken for the proposed Scheme, as described in Chapter 12 (Geology, Soils, Contaminated Land and Groundwater). The findings of the GI have helped in the development of the drainage design by determining the feasibility of discharges to groundwater via soakaway.

Impact Assessment

13.3.12 The impact assessment has been carried out using the general approach outlined in Chapter 5 (Overview of Assessment Process) and, in accordance with DMRB HD45/09, the approach has also been informed by consultation with SEPA, where appropriate (refer to Chapter 6: Consultation and Scoping).

13.3.13 The level of significance of an impact (both without and with mitigation) has been determined based on the importance of an attribute of a SWF combined with the magnitude of potential impact, during both construction and operation.

Importance

13.3.14 The importance of an attribute of a SWF (e.g. conveyance of flow/flood risk, fluvial geomorphology, water supply or biodiversity) was categorised on a scale of 'very high' to 'low', in accordance with the criteria provided in Table 13.1 (based on Table A4.3 in DMRB HD45/09) and professional judgement where appropriate. Attributes considered included conveyance of flow/flood risk, fluvial geomorphology, water quality/supply, dilution and removal of waste products and biodiversity.

13.3.15 The sensitivities assigned to each attribute of a feature are relevant to the surveyed reach and not necessarily the entire catchment. For example, a small tributary may be within the catchment of a designated salmonid water, but not be considered to be of very high importance in terms of water quality for reasons such as size, morphology, location, bed quality and low likelihood of supporting substantial salmonid populations. Table 13.1 below has been used as a guide rather than a rigid classification tool, and specialist judgement has also been used.

Table 13.1 Typical Indicators of the Importance of SWFs

Importance	Criteria
Very high	**Attribute has a high quality and rarity on regional or national scale.** **Hydrology and Flood Risk:** Water feature with direct flood risk to the adjacent populated areas, with greater than 100 residential properties at risk or critical social infrastructure units such as hospitals, schools, safe shelters or other land use of great value (the A96 is considered to be a strategically important piece of national infrastructure, forming a key part of the Scottish trunk road network). A water feature with hydrological importance to: i) sensitive and protected ecosystems of international status; ii) critical economic and social uses (e.g. water supply, navigation, recreation, amenity). A water feature or flood plain that provides critical flood alleviation benefits. **Fluvial Geomorphology:** A very high sensitive watercourse must show no, or limited signs, of previous modification and/or be experiencing no morphological pressures at the current

Importance	Criteria
	time. Sediment regime: Watercourse appears to be in complete natural equilibrium. That is, it is operating as a sediment source, sink or transfer zone and is not undergoing excessive unnatural deposition and/or erosion. It may also be the case that such an environment supports a range of species and habitats which would be sensitive to a change in suspended sediment concentrations and turbidity such as migratory salmon or freshwater pearl mussels. Channel morphology: Watercourse exhibits a natural range of morphological features such as pools and riffles, active gravel bars and varied river bank types, with no signs of modifications or morphological pressures. Natural fluvial processes: A watercourse where there is a diverse range of fluvial processes which are free from any modification or anthropogenic influence, which would be highly vulnerable to changes as a result of modifications. **Water Quality:** Site is protected/designated under European Commission (EC) or UK habitat legislation (Special Area of Conservation (SAC), Special Protection Areas (SPA), Site of Special Scientific Interest (SSSI), Water Protection Zones (WPZ), Ramsar site or salmonid water). WFD overall status of 'High'. None or only limited anthropogenic pressures which are not significantly affecting the aims of the WFD. Water quality complies with Environmental Quality Standards (EQS). EC designated Salmonid/Cyprinid Fishery. Species protected under EC legislation. Watercourse widely used for recreation, directly related to its quality (e.g. swimming, salmon fishery).
High	**Attribute has a high quality and rarity on local scale.** **Hydrology and Flood Risk:** Water feature with direct flood risk to the adjacent populated areas, with between 1 and 100 residential properties or industrial premises at risk from flooding. Critical social infrastructure not affected. A water feature with hydrological importance to: i) sensitive and protected ecosystems of national designation; ii) locally important economic and social uses (e.g. water supply, navigation, recreation, amenity). A water feature or flood plain providing significant flood alleviation benefits. **Fluvial Geomorphology:** Sediment regime: A highly sensitive watercourse appears to be in natural equilibrium. That is, it is operating as a sediment source, sink or transfer zone and is not undergoing excessive unnatural deposition and/or erosion. It may also be the case that such an environment supports a range of species and habitats which would be sensitive to a change in suspended sediment concentrations and turbidity such as migratory salmon or freshwater pearl mussels. Channel morphology: Watercourse exhibits a natural range of morphological features such as pools and riffles, active gravel bars and varied river bank types, with very limited signs of modifications or morphological pressures. Natural fluvial processes: A watercourse where there is a diverse range of fluvial processes which have very limited signs of modifications or anthropogenic influences, which would be highly vulnerable to changes in fluvial processes as a result of modifications. **Water Quality:** WFD overall status of 'Good'. Water quality complies with EQS. Major cyprinid fishery. Species protected under EC or UK legislation. Watercourse used for recreation.
Medium	**Attribute has a medium quality and rarity on local scale.** **Hydrology and Flood Risk:** Water feature with a possibility of direct flood risk to less populated areas without any critical social infrastructure units such as hospitals, schools, safe shelters and/or utilisable agricultural fields. A water feature with some but limited hydrological importance to: i) sensitive or protected ecosystems; ii) economic and social uses; iii) the flooding of 10 or fewer industrial properties. A water feature or flood plain that provides some flood alleviation benefits. **Fluvial Geomorphology:** Sediment regime: Watercourse shows signs of modification and is recovering a natural equilibrium. That is, it is operating as a source, sink or transfer zone but may be undergoing elevated levels of deposition and/or erosion. It may also be the case that such an environment supports limited species and habitats which may be slightly sensitive to a change in suspended sediment concentrations and turbidity. Channel morphology: Watercourse exhibits a limited range of morphological features such as pools and riffles, few active gravel bars and relatively uniform bank types, with signs of modifications and morphological pressures. There may be signs of recovery of morphological features, such as the development of berms within an over wide channel. Natural fluvial processes: A watercourse where there is a limited range of fluvial processes which are influenced by modifications or anthropogenic influences, which would be vulnerable to changes in fluvial processes as a result of modifications. **Water Quality:** WFD overall status of 'Moderate'. Likely to exhibit a measurable degradation in water quality as a result of anthropogenic factors. May be subject to improvement plans by SEPA. Watercourse not widely used for recreation, or recreation use not directly related to quality.
Low	**Attribute has a low quality and rarity on local scale.** **Hydrology and Flood Risk:** Water feature passing through uncultivated agricultural land.

Importance	Criteria
	A water feature with minimal hydrological importance to: i) sensitive or protected ecosystems; ii) economic and social uses; iii) with a low probability of flooding of residential and industrial properties and is a water feature or flood plain that provides minimal flood alleviation benefits. **Fluvial Geomorphology:** Sediment regime: Watercourse that has a highly modified sediment regime. That is, the natural equilibrium of the watercourse as a source, sink or transfer zone has been changed by channel modifications or anthropogenic pressures. The watercourse may have insufficient capacity to recover its natural equilibrium and is stable acting as a transfer or sink of sediment. It may also be the case that such an environment does not support any significant species sensitive to changes in suspended solids concentration or turbidity. Channel morphology: Watercourse exhibits no morphological diversity; uniform flow, gravel bars are absent and bank types uniform. May have been subject to past modification such as bank protection and culverting. Likely to be stable with insufficient capacity to develop morphological features. Natural fluvial processes: A watercourse which shows no evidence of active fluvial processes and is not likely to be affected by modification to boundary conditions. **Water Quality:** WFD overall status of 'Poor' or 'Bad'. Highly likely to be affected by anthropogenic factors. Heavily engineered or artificially modified and may dry up during summer months. Fish sporadically present or restricted; no species of conservation concern. Not used for recreation purposes.

Magnitude of Impact

13.3.16 The magnitude of impact was assessed on a scale of major, moderate, minor and negligible based on professional judgement guided by the criteria and typical examples shown in Table 13.2. The magnitude of an impact is influenced by timing, scale, size and duration of change to the baseline conditions, and can be either adverse or beneficial, as defined in Table 13.2.

13.3.17 It should be noted that DMRB HD45/09 classifies the magnitude of potential impacts on flood level using the 1% Annual Exceedance Probability (AEP) (100 year return period) event. In Scotland the design standard (from SPP) is the 0.5% AEP (200 year return period) event and therefore the magnitude of impacts has been assessed using the 0.5% AEP event.

13.3.18 For operational impacts on water quality, one of the aspects considered is whether the water quality in the receiving watercourse would achieve a 'Pass', when using the Highways Agency Water Risk Assessment Tool (HAWRAT). Paragraphs 13.2.54 to 13.2.60 provide details of the HAWRAT methodology.

13.3.19 It should be noted that when any of the criteria are met from one of the more adverse categories of magnitude described in Table 13.2, then that magnitude of impacts is applied.

Table 13.2: Typical Criteria for Estimating the Magnitude of Impact on SWFs (adapted from Table A4.4 in DMRB HD45/09)

Magnitude	Typical Examples
Major adverse	**Results in loss of attribute and/or quality and integrity of the attribute.** **Hydrology and Flood Risk:** Major changes to flow regime (low, mean and/or high flows – at the site, upstream and/or downstream). An alteration to a catchment area in excess of a 25% reduction or increase. Significant increase in the extent of 'medium to high risk' areas (classified by the Risk Framework of SPP. This means there would be significantly more areas/properties at risk from flooding by the 0.5% or greater AEP (200-year) flow. An increase in peak flood level during a 0.5%AEP (200-year) event of >100mm. **Fluvial Geomorphology:** More than four new watercourse crossings or structures (including outfalls) required, significantly increasing the extent of watercourse modification which has the potential to resulting in the following changes: Sediment regime: Major change to the natural equilibrium through modification, significantly changing the natural function of the watercourse (sediment source, sink or transfer zone). This may arise from a major increase in amount of fine sediment and turbidity. Channel morphology: Major impacts on channel morphology through the removal of a wide range of morphological features and/or replacing a large extent of the natural bed and/or banks with artificial material. Major channel realignment significantly altering the natural channel planform and bank profiles typically in the loss of sinuosity, increased channel gradient and higher stream powers. This poses erosion risk problems due to the higher stream energy. Major realignment impacts on natural channel processes, which has knock-on

Magnitude	Typical Examples
	effects on sediment regime, flow diversity and depositional features. Natural fluvial processes: Major interruption to fluvial processes such as channel planform evolution or erosion and deposition. **Water Quality:** Major shift away from the baseline conditions. Equivalent to downgrading two WFD classes, e.g. from Good to Poor, or any change that downgrades a site in quality status as this does not comply with the WFD. Failure of both soluble and sediment-bound pollutants in HAWRAT and compliance failure with EQS values. Calculated risk of pollution from a spillage >2% annually. Loss or extensive change to a fishery or a designated nature conservation site.
Moderate adverse	**Results in effect on integrity of attribute, or loss of part of attribute.** **Hydrology and Flood Risk:** Moderate shift away from baseline conditions and moderate changes to the flow regime. An alteration to a catchment area in excess of 10% but less than 25%. Moderate increase in the extent of 'medium to high risk' areas (as defined by SPP). An increase in peak flood level (for a 0.5% AEP event) >10 mm resulting in an increased risk of flooding to >100 residential properties or an increase of >50 mm resulting in an increased risk of flooding to 1-100 residential properties. **Fluvial Geomorphology:** One to three additional watercourse crossings or structures (including outfalls) required, increasing the extent of watercourse modification which has the potential to result in the following changes: Sediment regime: Moderate change to the natural equilibrium through modification, partially changing the natural function of the watercourse (sediment source, sink or transfer zone). This may arise from a moderate increase in amount of fine sediment and turbidity. Channel morphology: Moderate impact on channel morphology through the removal of a range of morphological features and/or replacing a medium extent of the natural bed and/or banks with artificial material. Channel realignment resulting in a moderate change in channel planform and bank profiles typically resulting in some loss of sinuosity, increased channel gradient and higher stream powers. Erosion risk may increase as a result of the increased gradient and stream power. The realignment would partially change natural channel processes, including sediment regime, flow diversity and depositional features. Natural fluvial processes: Moderate interruption to fluvial processes such as channel planform evolution or erosion. **Water Quality:** Moderate shift from the baseline conditions that may be long-term or temporary. Equivalent to downgrading one WFD class, e.g. from Moderate to Poor. Failure of both soluble and sediment-bound pollutants in HAWRAT but compliance with EQS values. Calculated risk of pollution from a spillage >1% annually and <2% annually. Partial loss in productivity of a fishery.
Minor adverse	**Results in some measurable change in attributes quality or vulnerability.** **Hydrology and Flood Risk:** Slight changes to the flow regime. An alteration to a catchment area in excess of 1% but less than 10%. Slight increase in the extent of 'medium to high risk' areas (as defined by SPP). An increase in peak flood level (for a 0.5% AEP event) >10 mm resulting in an increased risk of flooding to fewer than 10 industrial properties. **Fluvial Geomorphology:** Upgrade to, or extension of, existing watercourse crossing or structure or construction of proposed route in close proximity to watercourse. This has the potential to result in: Sediment regime: Minor change to the natural equilibrium through modification, locally changing the natural function of the watercourse (sediment source, sink or transfer zone). This may arise from a slight increase in amount of fine sediment and turbidity. Channel morphology: Limited impact on channel morphology, through removal of some morphological features and/or replacing a small extent of the natural bed and/or banks with artificial material. Minor realignments, typically localised around structures such as culverts and bridges having limited impact on channel planform, gradient, bank profiles and channel processes. Natural fluvial processes: Slight change in fluvial processes operating in the river; any change is likely to be highly localised. **Water Quality:** Minor shift away from the baseline conditions. Equivalent to minor but measurable change within the WFD classification scheme. Failure of either soluble or sediment-bound pollutants in HAWRAT. Calculated risk of pollution from a spillage >0.5% annually and <1% annually.
Negligible	**The proposed Scheme is unlikely to affect the integrity of the water environment.** **Hydrology and Flood Risk:** Negligible changes to the flow regime (i.e. changes that are within the monitoring errors). An alteration to a catchment area of less than 1% reduction or increase in area. Negligible change in the extent of 'medium to high risk' areas (as defined by SPP). Negligible change in peak flood level (for a 0.5% AEP event) <±10mm. **Fluvial Geomorphology:** No direct engineering impact but potential indirect impact due to

Magnitude	Typical Examples
	proximity of the watercourse to the proposed Scheme. Sediment regime: Negligible change to the natural equilibrium. Negligible amount of sediment released into the watercourse, with no noticeable change to the turbidity or bed substrate. Channel morphology: No significant impact on channel morphology in the local vicinity of proposed site. Natural fluvial processes: No change in fluvial processes operating in the river; any change is likely to be highly localised. **Water Quality:** No perceptible changes to water quality and no change within the WFD classification scheme. No risk identified by HAWRAT (Pass both soluble and sediment-bound pollutants). Risk of pollution from a spillage <0.5%.
Minor beneficial	**Results in some beneficial effect on attribute or a reduced risk of negative effect occurring.** **Hydrology and Flood Risk:** Minor improvement over baseline conditions. It would involve a reduction in peak flood level (for a 0.5% AEP event) >10 mm. **Fluvial Geomorphology:** Slight improvement of the river channel from baseline conditions as a consequence of the works. *Note: beneficial impacts would only arise on impacted/modified/artificial water features. The greatest improvement would occur on water features that have a uniform morphology, acting as a transfer (larger watercourses) or sink (minor watercourses with limited flow and overgrown vegetation) of sediment and no signs of active fluvial processes.* Sediment regime: Slight improvement towards natural equilibrium, which is returning the function of the watercourse (sediment source, sink or transfer of sediment) to a natural one. Channel morphology: Limited improvement to morphological diversity. Natural fluvial processes: Slight change to fluvial processes which results in improved river forms and habitats. **Water Quality:** Minor improvement over baseline conditions. HAWRAT assessment of either soluble or sediment-bound pollutants becomes Pass from an existing site where the baseline was a Fail condition. Calculated reduction in existing spillage risk by 50% or more (when existing spillage risk is <1% annually).
Moderate beneficial	**Results in moderate improvement of attribute quality.** **Hydrology and Flood Risk:** A measurable improvement over baseline conditions involving a reduction in peak flood level (for a 0.5% AEP event) >50 mm. **Fluvial Geomorphology:** Improvement to a watercourse as a result of the works through means of some restoration or mitigation. This could provide a moderate improvement from baseline conditions. Sediment regime: Moderate improvement towards natural equilibrium, which is returning the function of the watercourse (sediment source, sink or transfer of sediment) to a natural one. Channel morphology: Moderate improvement to morphological diversity. Natural fluvial processes: Moderate change to fluvial processes which results in improved river forms and habitats. **Water Quality:** A moderate improvement over baseline conditions, which may result in the upgrade of quality status in line with the requirements of the WFD. HAWRAT assessment of both soluble and sediment-bound pollutants becomes Pass from an existing site where the baseline was a Fail condition. Calculated reduction in existing spillage risk by 50% or more (when existing spillage risk is >1% annually).
Major beneficial	**Results in major improvement of attribute quality.** **Hydrology and Flood Risk:** Major improvement over baseline conditions. The reduction in peak flood level (for a 0.5% AEP event) of >100 mm. **Fluvial Geomorphology:** Significant improvement to a watercourse as a result of substantial restoration or mitigation. This could provide a major improvement from baseline conditions. Sediment regime: Major improvement towards natural equilibrium, which is returning the function of the watercourse (sediment source, sink or transfer of sediment) to a natural one. Channel morphology: Major improvement to morphological diversity. Natural fluvial processes: Major change to fluvial processes which results in improved river forms and habitats. **Water Quality:** Major improvement over baseline conditions, whereby the removal or likelihood of removal of existing pressures, results in a watercourse which meets the requirements of the WFD.

Significance of Impact

13.3.20 The significance of an impact (both without and with mitigation) was determined as a function of the importance of an attribute and the magnitude of a predicted impact on that attribute, as outlined in Table 13.3. An impact can be beneficial or adverse. The assessment of significance was carried out using the matrices set out in Table 13.3. In some instances, the use of these tables creates two

potential outcomes, requiring a choice to be made in the level of significance (e.g. the significance of impact on an attribute of high importance can be either Moderate or Large when the magnitude is moderate). Where this occurs, professional judgement was used to determine the most likely significance.

13.3.21 For the purposes of this assessment, in line with the EIA Regulations, 'significant' impacts are defined as:

- impacts of Moderate significance and above for fluvial geomorphology and water quality attributes; and
- impacts of Slight significance and above for hydrology and flood risk.

Table 13.3: Matrix for Determining Impact Significance (adapted from Table A4.5 in DMRB HD45/09)

Importance \ Magnitude	Negligible	Minor	Moderate	Major
Very high	Neutral	Moderate/Large	Large/Very Large	Very Large
High	Neutral	Slight/Moderate	Moderate/Large	Large/Very Large
Medium	Neutral	Slight	Moderate	Large
Low	Neutral	Neutral	Slight	Slight/Moderate

Specific Methodologies

13.3.22 Under DMRB HD45/09, it is mandatory to use the following procedures to assess the potential impacts from road projects on the water environment:

- Method A – Effects of Routine Runoff on Surface Waters;
- Method C – Effects of Routine Runoff on Groundwater (if discharges to groundwater are proposed);
- Method D – Pollution Impacts from Accidental Spillages; and
- Methods E and F – Assessing Flood Impact.

13.3.23 Full methodologies are set out in DMRB HD45/09, Annex I: Assessment Methods.

Hydrology and Flood Risk

13.3.24 Within the study area, a total of 28 watercourses have been identified as having the potential to be impacted in terms of flood risk and hydrology by the proposed Scheme (and associated infrastructure). These watercourses range in size from small drainage ditches to larger watercourses such as the River Nairn.

13.3.25 The hydrology and FRA of these watercourses consists of the determination of baseline conditions (assessed in the absence of any influence or change due to the proposed Scheme) and an assessment of conditions post development to identify any impacts arising due to the proposed Scheme. Each stage of the assessment is discussed in further detail below.

Baseline Assessment

13.3.26 The baseline Hydrology and FRA considered the hydrology of the catchments and the existing flood risk in the study area, assessed in the absence of any influence or changes resulting from the proposed Scheme.

13.3.27 Full details of the hydrology assessment/flow derivation methods are provided in Appendix A13.2 (Flood Risk Assessment). A brief summary of the assessment methods are presented below.

13.3.28 For each watercourse and water feature along the route of the proposed Scheme, the following flow estimates have been calculated/estimated for existing baseline conditions:

- the index flood (QMED);
- peak flows have been derived for the following range of AEP events: 50%, 20%, 10%, 3.33%, 2%, 1%, 0.5% and 0.1% (i.e., 2, 5, 10, 30, 50, 100, 200 and 1000-year return period);
- Q_{95} – the 95-percentile flow (a measure of low flow); and
- Q_{mean} – mean flow.

13.3.29 FEH statistical methodologies (i.e. the pooling group method) was used to derive a growth curve to allow estimates of the peak flow using QMED for all ungauged catchments within the A96 corridor for the range of AEPs noted above. For comparison the FEH rainfall-runoff approach was also applied, though the highly permeable nature of the small catchments challenges the suitability of this method.

13.3.30 Only one Peak Flow rated river gauging station (7004 Nairn at Firhall) exists within the study area located approximately 0.6km downstream of the proposed Scheme. Hydrometric data including up-to-date AMAX and 15 minute time series data from November 1978 to September 2015 along with predicted design flow for various return periods (e.g. 50%, 10%, 3.33%, 1%, 0.5% and 0.01% AEP events) along the River Nairn were supplied by SEPA. Flood frequency analyses were undertaken at the Fairhall gauging station including single site analysis, enhanced single site analysis and FEH pooling group analysis. The enhanced single site growth curve was selected to best represent the River Nairn. The enhanced single site growth curve was then applied to the gauged QMED to derive design peak flows for the gauge.

13.3.31 The hydrograph shape for the River Nairn was derived from the historic flood events at the Nairn at Firhall gauge. A representative hydrograph shape was chosen from a comparison of the five largest flood events on record at the gauging station. The largest event on record (the July 1997 flood event) was selected as representing a typical hydrograph shape for the watercourse and taken forward for use in the River Nairn hydraulic model. For all modelled ungauged minor watercourses the FEH rainfall-runoff based hydrograph shape was used for input into the hydraulic model.

13.3.32 An initial scoping assessment was undertaken whereby the most appropriate detailed assessment methodology was identified for each water feature according to the following:

- Susceptibility of land within the study area to fluvial flooding from watercourses, coastal flooding, surface water flooding and groundwater flooding according to SEPA Flood Maps, as available in September 2015. These maps provide estimates of the areas of land with a high (10% AEP or 10-year return period), medium (0.5% AEP or 200-year return period), and low (0.1% AEP or 1000-year return period) likelihood of flooding in a given year (SEPA 2015a). It should be noted that SEPA Flood Maps provide a community level view of flood risk and are not intended to be used to identify if an individual property is affected by flooding. The Flood Maps do, however, provide an indication of areas of land which may be likely to flood which helps identify potential high, medium and low flood risk areas.
- Sensitivity of local flood receptors in the vicinity of medium likelihood fluvial flood extents shown on SEPA (2015a).
- Anticipated hydraulic complexity of the watercourse within the study area.

13.3.33 In the case of water features with small catchments of 3km^2 or less, SEPA Flood Maps (2015a) do not provide information. For these water features, the sensitivity of receptors in the immediate vicinity of the watercourse or water body was considered in conjunction with the hydraulic complexity of the water feature to assign the appropriate detailed assessment methodology.

13.3.34 Watercourses identified to have complex catchments and/or have the potential for a significance of flooding of medium or higher, and/or have complex channel hydraulics in the vicinity of the proposed Scheme have been subject to hydraulic modelling to allow detailed consideration to the baseline flood risk. Hydraulic modelling was undertaken using the ISIS/Flood Modeller Pro and

TUFLOW software packages (Flood Modeller Pro 2016 and TUFLOW 2015) and the following input data:

- 0.5% AEP (200-year return period) plus climate change hydrographs derived as noted above;
- channel and hydraulic structure information as collected through the topographic survey; and
- other hydraulic and connectivity information, which was established during a site walkover.

13.3.35 Modelling of the high-risk watercourses determined the capacity of the existing river system to pass the design flows at the point of interest (typically the A96 crossing), and in the vicinity of flood-sensitive receptors.

13.3.36 Those watercourses identified to pose lower risk, or have straightforward catchments and channel hydraulics were assessed by hand calculations and in some cases simple routing models (if the hand calculations indicated flow in the watercourse went out of bank for the design simulation). Baseline condition assessment considered the hydraulic performance of existing structures (culverts, bridges etc.) and channels in the vicinity of the preferred alignment, measured against the 0.5% AEP (200-year) plus climate change design flows.

13.3.37 Appendix A13.2 (Flood Risk Assessment) describes the hydraulic modelling undertaken to support this ES.

13.3.38 Once hydraulic modelling has been completed for the selected high/medium flood risk watercourses, the baseline flood risk will be revised for each watercourse based on predicted flood extents.

Impact Assessment

13.3.39 The proposed Scheme requires the assessment of the following impacts:

- reduction in flood plain capacity;
- restriction to flood flows at crossing locations;
- effectiveness of any proposed mitigation works; and
- residual impacts of the proposed Scheme on flood risk.

13.3.40 The potential impacts of new and revised watercourse crossings have been assessed using a combination of hand calculations and desk-based assessment in the case of simple, relatively low-risk watercourses; and numerical hydraulic modelling in the case of more complex or high-risk watercourses such as the River Nairn. Both methodologies have provided estimations of the probable changes in water levels (and hence flood extents) along the watercourse in the vicinity of the proposed Scheme. The details of assessment methods used at each water feature are included in Appendix A13.2 (Flood Risk Assessment).

13.3.41 New crossing structures have been designed to pass the 0.5% AEP flow (plus climate change allowance – see below) plus a minimum freeboard allowance in line with DMRB HD45/09 and SEPA guidance (SEPA 2015d). In some cases, greater freeboard has been required to meet ecological or other needs.

13.3.42 Loss of flood storage has been assessed by considering the alteration of the flood plain by the proposed Scheme. Proposed mitigation measures have been justified by their inclusion in revisions to the impact assessment calculations.

13.3.43 The potential impacts of watercourse realignments were assessed through hydraulic modelling to estimate potential impacts on water levels along the watercourse based on the proposed channel dimensions and grade.

Allowance for Climate Change

13.3.44 Climate change considerations are required to be included in the FRA. Based on the outcome of previous consultation with SEPA (CH2M 2015a), an allowance for climate change is not a required design criterion, but consideration of long-term sustainability for the route is required. At present the general industry approach to climate change is to increase estimates by 20% in order to take into consideration the potential increase in flood flows that may occur in future as a result of a warmer climate. A 20% uplift factor has therefore been applied to design flows in order to take climate change considerations into account (DMRB HD45/09; EA 2013; and SEPA 2014).

13.3.45 No climate change adjustment factor has been applied to the low flows estimates as it is not perceived as appropriate to adjust low flows estimates for climate change. This is due to climate change potentially resulting in more extreme weather conditions i.e. increased higher flows but potentially lower low flows.

Fluvial Geomorphology

Baseline Assessment

13.3.46 DMRB HD45/09 does not outline a specific methodology for fluvial geomorphology impact assessment. The methodology adopted in this assessment was developed using the guidelines from research and development programmes of the National Rivers Authority, EA and Scottish Natural Heritage (SNH), including:

- The Fluvial Design Guide (EA 2010);
- River Geomorphology: A Practical Guide (EA 1998); and
- Guidebook of Applied Fluvial Geomorphology (Sear, Newson and Thorne 2010).

Impact Assessment

13.3.47 The importance of watercourses is assessed based upon the following: sediment regime; channel morphology; and natural fluvial processes. This includes assessment of the structure and substrate of the bed and banks, flow and sediment dynamics, bedforms, riparian zone characteristics, lateral and longitudinal connectivity and the impact of structures (e.g. bridges, culverts and weirs). In addition, WFD status and the presence of designated sites are considered in the importance classification. Table 13.1 summarises the criteria for assessing the importance of watercourses.

13.3.48 The magnitude of potential impacts to baseline conditions considers the timing, scale, size, type, location and duration (long-term, temporary or permanent) of construction activities and operational structures (e.g. culverts, outfall construction and channel realignments). This includes assessment of likelihood of occurrence of the potential impacts. The criteria used to assess the magnitude of an impact is summarised in Table 13.2.

13.3.49 The significance of impact is determined as a function of the importance of the water feature and the magnitude of impact, as defined in Table 13.3.

Water Quality

Baseline Assessment

13.3.50 A range of information was used to inform the baseline water quality assessment, including:

- Biological and physico-chemical water quality data from SEPA-monitored watercourses within the study area. Where no data exists for smaller/minor watercourses, surrounding land use and potential pollution sources were used to infer existing water quality.
- A review of information contained within the online SEPA RBMP Interactive Map (SEPA 2015b) including the current WFD water quality classification status, existing anthropogenic pressures and any improvement measures identified, and fisheries designations of monitored water bodies

within the study area. This is in line with the requirements of the WFD, as detailed in Section 13.2 (Legislative and Policy Background).

Impact Assessment

13.3.51 The impacts on various attributes of the different features of the water environment have been considered. These attributes include water quality, flow conveyance, protected areas, drinking water supply, effluent discharges and recreation. The water quality assessment is primarily concerned with surface water. The assessment of groundwater quality is covered in Chapter 12: Geology, Soils, Contaminated Land and Groundwater.

13.3.52 The assessment of the magnitude of construction impacts has considered the types and extent of construction activities (e.g. SWF crossing, channel realignments, outfall construction); proximity to SWF (and requirements for in-channel works); and the relative size of the SWF with regard to its potential to dilute and disperse contaminants and potential spillages.

13.3.53 The assessment of operational impacts relating to routine runoff and spillage risk has been carried out in line with the methods contained in DMRB HD45/09 (Method A and Method D, respectively). The assessment of the magnitude and significance of operational impacts has taken into account the nature of the SWFs proposed to receive road drainage and the dilution or dispersal potential of the SWFs.

13.3.54 Following Method A of DMRB HD45/09, the HAWRAT has been used to calculate whether the proposed Scheme would 'pass' or 'fail' in terms of water quality in the receiving SWFs during operation. The HAWRAT tool applies a number of factors to quantify the risk of pollution from routine runoff. Twenty-six outfalls into 14 SWFs have been assessed by the HAWRAT tool.

13.3.55 The HAWRAT routine runoff assessment has a three step approach, as follows:

- Step 1: pollutant concentrations in highway runoff only (i.e. before mixing in the watercourse);
- Step 2: pollutant concentrations after mixing (i.e. taking into account the flow in the watercourse); and
- Step 3: the effectiveness of proposed treatment systems mitigation measures is assessed.

13.3.56 Step 2 contains two tiers of assessment for sediment accumulation. Tier 1 is a simple assessment requiring only an estimate of the river width. If required, Tier 2 is a more detailed assessment which requires measurements of the physical dimensions of the river. For the assessment of the proposed Scheme, outfalls that failed the Step 2, Tier 1 assessment were taken straight to Step 3, instead of Step 2, Tier 2, because Step 3 assesses the effectiveness of proposed treatment measures (Step 2 does not include mitigation) and SEPA had requested a minimum level of SUDS treatment upstream of each outfall (three levels into the River Nairn and its tributaries; two levels for all other watercourses). As this mitigation was a requirement of SEPA, Step 3 assessments were undertaken to determine if the HAWRAT Fails recorded at Step 2, Tier 1 would become HAWRAT Passes at Step 3, when the required level of mitigation was included. With the exception of Outfall O, combined Outfalls H and I and combined outfalls P and Q, all outfalls passed the Step 3 assessments with the level of mitigation required by SEPA, justifying omission of Step 2, Tier 2 assessments for these outfalls. Step 2, Tier 2 assessments were then completed for those outfalls that did not pass the Step 3 assessment with the required mitigation (Outfall O (individual assessment), Outfalls H and I (cumulative assessment) and Outfalls P and Q (cumulative assessment)).

13.3.57 HAWRAT results show both soluble acute and sediment chronic impacts; the results are shown as a pass, fail or alert. An alert is given for outfalls that would otherwise pass the assessment for sediment-bound pollutants, were it not for a protected site, structure, lake or pond being present downstream. Protected sites include: Sites of Special Scientific Interest (SSSIs), Water Protection Zones, Ramsar and EU Natura 2000 (Special Areas of Conservation and Special Protection Areas) sites; and Protected Areas under the WFD. The alert indicates the need for further consideration of the proposed outfall and the agreement of appropriate settlement measures with SEPA.

13.3.58 In Tables 13.5 to 13.7, 13.14 to 13.16, and 13.21 to 13.23 (HAWRAT assessment results), alerts are reported as Alert 1, Alert 2 and Alert 3. The type of alert referred to is as follows:

- Alert 1: a protected site within 1km of the point of discharge.
- Alert 2: a structure, lake or pond within 100m of the point of discharge.
- Alert 3: protected site and structure, lake or pond downstream and within the relevant distances of outfall.

13.3.59 Method D of DMRB HD45/09, which is also included in the HAWRAT tool, has been used to calculate spillage risk during operation and the associated probability of a serious pollution incident. The risk is calculated assuming that an accident involving spillage of pollutants onto the dual carriageway alignment would occur at an assumed frequency, expressed as annual probabilities, based on calculated traffic volumes and the type of road/junction. The annual probability of a serious accidental spillage leading to a serious pollution incident also depends upon the emergency services response time. A risk factor is applied depending on the location and likely response time and the type of receiving water body.

13.3.60 The results of the HAWRAT calculations have been used to determine the magnitude and significance of the effects during operation.

Mitigation

13.3.61 Potential mitigation measures have been considered during this assessment and take into account best practice, legislation, guidance and professional experience.

13.3.62 As described in Chapter 1 (Introduction) and Chapter 5 (Overview of the Assessment Process) the mitigation commitments and monitoring frameworks identified in the Strategic Environmental Assessments (SEAs) for the Strategic Transport Projects Review (STPR) (Jacobs, Faber Maunsell, Grant Thompson and Tribal Consulting 2008) and A96 Dualling Programme (CH2M 2015 and 2016) have also been taken into consideration in relation to the mitigation proposals.

13.3.63 The mitigation commitments relevant to the water environment detailed within the STPR SEA include:

- *'All activities associated with interventions should be carried out in accordance with the Controlled Activities Regulations (CAR). The regulations relate both to construction and operational impacts. In order to ensure proportionate controls over activities, the Regulations provide for three levels of control: General Binding Rules (GBR), Registrations and Water Use Licences. If site-specific controls are required and, in particular, if constraints upon the activity are to be imposed then the activity should be authorised using a licence.*
- *A detailed drainage design incorporating Sustainable Urban Drainage Systems (SUDS) should be considered to address flooding and potential drainage issues as a result of constructing and operating the intervention, where this is appropriate.*
- *Water pollution control measures should be provided to ensure that pollutant concentrations in receiving waters remain within the limits for the appropriate water quality objective for the watercourse or where this is not available, for the current water quality classification'.*

13.3.64 The mitigation commitments relevant to the water environment detailed within the A96 Dualling Programme SEA include:

- *'Avoid new infrastructure in the functional floodplain (recognising that this may not be achievable in all locations), safeguarding flood storage and conveying capacity.*
- *Where unavoidable, new infrastructure should be restricted to the shortest practical crossing, avoiding extensive construction within the functional floodplain and ensuring no net change in flood risk.*
- *Avoid developing SUDS in the functional floodplain.*

- *Water discharged from SUDS should not result in the deterioration of water quality or hydrogeomorphological effects in the receiving watercourse.*
- *All design should be undertaken in line with the full list of SFRA recommendations and in consultation with SNH and SEPA'.*

13.3.65 The specific mitigation measures in relation to the proposed Scheme are discussed further in Section 13.8 (Mitigation).

Limitations

13.3.66 There are certain limitations within each discipline with regards to the assessment methodologies, as outlined in the following paragraphs.

Hydrology and Flood Risk

13.3.67 The majority of watercourses within the study area have small ungauged catchments. The only flow gauge available within the study area is gauge 7004 (Nairn at Firhall). Flow estimation is complex especially for small ungauged catchments and open to greater uncertainty than for larger gauged catchments with a long quality controlled/checked flow record. However, suitable FEH methodologies have been used to estimate flows for the ungauged catchments.

Fluvial Geomorphology

13.3.68 The walkover surveys provide a snapshot of the watercourses and processes occurring at one point in time. However, conditions which vary seasonally (such as vegetation growth, land use, and water levels) can affect fluvial processes and changes to the morphology of the channel. The predominant sediment regime and stability of the watercourse was inferred through the features observed. Where bank material was found to be obscured due to vegetation growth and limited access, observations were made at upstream and downstream locations and nearby tributaries to help indicate the boundary conditions.

13.3.69 Some of the watercourses were not observed during the DMRB Stage 3 assessment due to land access constraints. However, data and information collected from the DMRB Stage 2 site visits was used to inform the assessment and minimise gaps in data.

13.3.70 At the time of survey, land access constraints meant that the following SWFs were not observed, nor were they surveyed for the DMRB Stage 2 assessment (Jacobs 2014):

- SWF 27;
- SWF 28;
- SWF 29;
- SWF 30; and
- SWF 32.

13.3.71 Due to the size and nature of these SWFs and the amount of information obtained during the desk study, this is not considered to have had an impact on the quality of this assessment, and as such numbering may not be sequential.

Water Quality

13.3.72 No water quality information was available from SEPA for some of the minor/small watercourses impacted by the proposed Scheme. However, information obtained from site visit observations, surrounding land use and any downstream designations have been taken into consideration during the assessment.

13.3.73 HAWRAT is an indicative assessment tool only, and the pass/fail result is not intended to be rigid. Therefore, in any instances where a 'fail' result is registered, the proposed Scheme drainage

design has been discussed with SEPA in order to ensure adequate protection of the water environment.

13.3.74 The HAWRAT routine runoff assessment has been completed for all of the drainage catchments along the dual carriageway alignment, as all of these are proposed to discharge to surface water via an outfall. The assessment has not been completed for any of the local roads that would be altered by the proposed Scheme. This is because HAWRAT is primarily designed for trunk roads and motorways with a relatively high level of traffic (>10,000 annual average daily traffic (Annual Average Daily Traffic (AADT)). This approach has been agreed with SEPA.

13.3.75 A Step 2, Tier 2 (detailed assessment) has been completed for Outfall O using estimates of bed slope, side slope and long slope based on aerial photography for the current ditch, downstream of the proposed outfall location. This is because Outfall O would discharge into a channel that does not currently exist (existing channel is to be extended during construction) so no measurements could be taken at the point of discharge. The values used for the other Step 2, Tier 2 assessments were taken from the information gathered during the watercourse topographical surveys.

13.3.76 Water hardness data was requested from SEPA for watercourses that flow within the study area. Data was only available for the River Nairn, from samples taken in 2012, 2013 and 2014. The data ranged from low hardness (less than 50mg of calcium carbonate per litre) to medium hardness (between 50mg and 200mg of calcium carbonate per litre). However, the majority of the results were within the low hardness band, and those that were within the medium hardness band were at the lower end. Therefore, it was considered reasonable to assume that the water hardness of the River Nairn and the other watercourses in the study area is low. This fits with the precautionary approach because, within HAWRAT, the allowable number of exceedances for the runoff specific thresholds increases with increasing hardness (i.e. using low water hardness is the worst case).

13.3.77 The values used in Appendix A13.3 (Water Quality Calculations) to calculate the indicative treatment efficiencies of the proposed treatment trains were taken from Table 3.2 of DMRB Volume 4, Section 2, Part 1, HA103/06 Vegetated Drainage Systems for Highway Runoff (Highways Agency, Scottish Government, Welsh Assembly Government and The Department for Regional Development Northern Ireland 2006) (hereafter HA103/06) and The SUDS Manual (CIRIA 2015). It should be noted that these values are only indicative, they are not precise. The values from DMRB HA103/06 were taken from a study to determine treatment efficiencies of a range of systems on different operational roads. DMRB HA103/06 states that *'Whilst the findings from this study are instructive the scope of the study was limited and the figures are given to indicate rather than prescribe the range of treatment efficiencies of certain systems'*. The treatment efficiencies and treatment efficiency calculations presented in Appendix A13.3 (Water Quality Calculations) were sent to SEPA for comment in May 2016 along with the results of the preliminary HAWRAT assessments. SEPA did not raise any concerns in relation to the use of these values.

13.3.78 Information about the road drainage network for the existing A96 was not available. Therefore, available contour data and aerial mapping has been used to make some assumptions about the existing drainage.

13.3.79 A spillage risk assessment has not been completed for the do minimum scenario. This is because the results of the do something assessment show that the risk of a serious pollution incident for each outfall (including the cumulative risk where more than one outfall discharges into the same reach) has an annual probability far below the 1% quoted in DMRB HD45/09 for outfalls that are not within 1km of a protected area and the 0.5% quoted in the guidance for outfalls that are within 1km of a protected area. It is reasonable to assume that the results of the Do Minimum assessment would be similar to, or lower than, the results of the do something assessment.

13.4 Baseline Description and Evaluation

13.4.1 The following existing (baseline) conditions relating to the water environment are described in Appendix A13.1 (Baseline Conditions):

- SWF descriptions, including water levels during the 0.5% AEP (200-year) plus climate change allowance design flood event and a description of the proposed in-channel works;

- nitrate vulnerable zones;
- water quality status;
- river flows;
- designated sites;
- discharge consents;
- water abstractions; and
- pollution incidents.

13.4.2 The baseline conditions reflect the Do Minimum Scenario, which is based on an assumption of no proposed Scheme and continued use of the existing road infrastructure.

13.4.3 This section provides an explanation for the SWFs that have been scoped out of the assessment; a summary of the existing road drainage network, including the results of the do minimum assessment; and a summary of the level of importance that has been assigned to each attribute of a SWF that has been scoped into the assessment.

SWF Numbering

13.4.4 During earlier assessments relating to route options for this proposed Scheme, all SWFs that flowed within 500m of any route option and had the potential to be impacted were given a reference number (SWF 01 to SWF 35). For consistency, the SWF reference numbers used previously have also been used in this assessment.

Scoping Out

13.4.5 The following SWFs from the earlier assessment have been scoped out of the DMRB Stage 3 assessment because they do not flow within the study area for the proposed Scheme: SWF 28; SWF 30; and SWF 32. Therefore, the total number of SWFs was 32. However, a number of these SWFs have since been scoped out of the assessment of construction and/or operational impacts. The reasons for this are detailed below. No additional SWFs have been scoped into the assessment.

13.4.6 SWF 20, SWF 25, SWF 27 and SWF 29 flow within the study area for the proposed Scheme but have been scoped out of the assessments (both construction and operation) for all three water environmental disciplines for the following reasons:

- there would be no in-channel works within these SWFs;
- there would be no operational discharges of routine runoff into these SWFs;
- given the distance between these SWFS and the proposed Scheme and/or the intervening relief of the land, there are unlikely to be any impacts from accidental spillages; and
- there would be no works associated with the proposed Scheme with potential to affect the flood risk of these SWFs.

13.4.7 For the same reasons as for SWF 20, SWF 25, SWF 27 and SWF 29, SWF 10 has been scoped out of the fluvial geomorphology and water quality assessments for both construction and operation; however it remains relevant to the hydrology and FRA. This is because SWF 10 joins SWF 09 approximately 250m upstream of the proposed road crossing point of SWF 09. In the case that SWF 09 is negatively impacted by the proposed Scheme, the effects may propagate upstream and cause flooding of SWF 10.

13.4.8 In addition to the SWFs mentioned above, the following SWFs have been scoped out of the operational assessment for water quality because there are currently no proposals to discharge routine runoff into these SWFs: SWF 01, SWF 04, SWF 05, SWF 07, SWF 11, SWF 12, SWF 14, SWF 15, SWF 17, SWF 21, SWF 31, SWF 33 and SWF 34.

13.4.9 Loch Flemington has been scoped out of the water quality assessment for both construction and operational impacts because it is located over 200m to the south of the proposed Scheme (at its closest point) and because the relief of the land rises between the Loch and the proposed Scheme.

13.4.10 Chapter 11 (Ecology and Nature Conservation) identifies 39 ponds within the study area (Figure 11.6: Protected Species). Two of these ponds, which are seasonal, would need to be removed to facilitate the scheme. Chapter 11 determines that a small number of the remaining ponds could be impacted by pollution from surface water runoff and spill events during construction, which would lead to reduced water quality and altered habitat. Therefore, ponds have also been considered in the assessment of construction impacts for water quality (although not individually). However, ponds re not considered in the operational assessment as they would not receive any discharges of routine runoff. In Chapter 11 (Ecology and Nature Conservation), the significance of impact on amphibians within these ponds in the absence of mitigation has been assessed as negligible during both construction and operation.

Existing Road Drainage Network

13.4.11 To allow an assessment of the existing situation, available contour data and aerial mapping has been used to make some assumptions about the existing drainage. This investigation has been largely based on the assumption that the road drainage outfalls along the existing A96 are located at low points. The assessment used contour data, where available (data was not available for all areas of the existing A96), to identify high and low points along the existing A96. In addition, aerial mapping was used to identify any visible existing treatment of discharge (e.g. filter drains, kerb outlets and linear channels). With regard to pre-treatment, filter drains provide a limited amount of filtration prior to the runoff discharging to a watercourse. Gulley drains and over the edge drainage into drainage ditches do not provide any treatment or attenuation. The results of the investigation into the existing road drainage network are shown in Table 13.4.

Table 13.4: Results of Investigation into Existing Road Drainage Network

Drainage Catchment/Outfall	Receiving Watercourse	Pre-treatment/Method of Flow
1	SWF 02	Gulley drainage
2	SWF 03	Gulley drainage
3	SWF 06	Gulley drainage
5	SWF 08	Gulley drainage
6	SWF 09	Over the edge
9	SWF 13	Over the edge
10	SWF 14	Filter drains
12	SWF 16	Filter drains
13	SWF 18	Filter drains
15	SWF 19	Over the edge
16A	SWF 26	Gulley drainage
16	SWF 26	Filter drains
17	SWF 26	Filter drains
17B	SWF 31	Filter drains

13.4.12 All of the SWFs identified as receiving flow from the existing A96 eventually flow into the Moray Firth (either directly or indirectly). The Moray Firth has a number of ecological designations. Refer to Chapter 11 (Habitats and Biodiversity) for further information on these designations. The assumed outfalls into SWF 02 (Outfall 1), SWF 03 (Outfall 2) and SWF 06 (Outfall 3) are thought to be located within 1km upstream of at least one of these protected areas.

13.4.13 In addition, SWF 26 is designated as a Protected Area for Freshwater Fish under the WFD (associated water body of the River Nairn). It is assumed that the following outfalls discharge routine road runoff into this SWF: Outfall 16A, Outfall 16 and Outfall 17.

13.4.14 HAWRAT routine runoff assessments have been completed for those watercourses that are thought to receive road runoff from the existing A96. The parameters used for, and the detailed results of, the HAWRAT routine runoff assessment can be found in Appendix A13.3 (Water Quality Calculations). This assessment of the existing situation has been completed to infer change, either beneficial or adverse, from the baseline. However, it should be noted that this is not an assessment of the baseline in terms of absolute pollutant loads and the results should not be linked to any existing surface water quality sampling information.

13.4.15 All of the existing outfalls identified during the road drainage network assessment failed Step 1 of the individual and cumulative assessments, as would normally be expected. Therefore, Step 2 assessments were completed for all of the catchments. This assessment considered the impacts of the existing outfalls in the absence of mitigation. The results of the Step 2 assessments are shown in Tables 13.5 to 13.7.

Table 13.5: Summary of Step 2 HAWRAT Individual Routine Runoff Assessment (Do Minimum)

Drainage Catchment/Outfall	Receiving Watercourse	HAWRAT Results		Compliance with Environmental Quality Standards
		Soluble Acute Impacts	Sediment Chronic Impacts	
1	SWF 02	Pass	Alert 1	Pass
2	SWF 03	Pass	Alert 3	Pass
3	SWF 06	Pass	Alert 3	Pass
5	SWF 08	Pass	Pass	Pass
6	SWF 09	Pass	**Fail**	Pass
9	SWF 13	Pass	**Fail**	Pass
10	SWF 14	Pass	Pass	Pass
12	SWF 16	Pass	Pass	Pass
13	SWF 18	**Fail**	**Fail**	Pass
15	SWF 19	Pass	Pass	Pass
16A	SWF 26	Pass	Alert 3	Pass
16	SWF 26	Pass	Alert 3	Pass
17	SWF 26	Pass	Alert 3	Pass
17B	SWF 31	Pass	Pass	Pass

Table 13.6: Summary of Step 2 HAWRAT Cumulative Routine Runoff Assessment for Soluble and Sediment Impacts (Do Minimum)

Drainage Catchment/Outfall	Receiving Watercourse	HAWRAT Results		Compliance with Environmental Quality Standards
		Soluble Acute Impacts	Sediment Chronic Impacts	
16A & 16	SWF 26	Pass	Alert 3	Pass

13.4.16 Tables 13.5 and 13.6 show that the following outfalls failed the HAWRAT routine runoff assessment for sediment-bound pollutants: Outfall 6 (SWF 09), Outfall 9 (SWF 13) and Outfall 13 (SWF 18). In addition, Outfall 13 (SWF 18) failed the assessment for soluble pollutants.

13.4.17 Outfall 13 (SWF 18) was then taken forward to Step 3, which considers the residual impacts following mitigation. The results of the Step 3 assessment can be found in Table 13.7.

Outfall 6 (SWF 09) and Outfall 9 (SWF 13) could not be taken forward to Step 3 because the investigation into the existing road drainage network did not identify any pre-existing treatment for these outfalls. Therefore, it is assumed that these outfalls are having an adverse impact on the water quality and biodiversity of SWF 09 and SWF 13.

Table 13.7: Summary of Step 3 HAWRAT Individual Routine Runoff Assessment (Do Minimum)

Drainage	Receiving	HAWRAT Results	Compliance with

Catchment/Outfall	Watercourse	Soluble Acute Impacts	Sediment Chronic Impacts	Environmental Quality Standards
13	SWF 18	**Fail**	**Fail**	Pass

13.4.18 Table 13.7 shows that, even with the inclusion of the existing mitigation, Outfall 13 (SWF 18) has failed the HAWRAT assessment for soluble and sediment-bound pollutants. Therefore, it is assumed that this outfall is having an adverse impact on the water quality and biodiversity of SWF 18.

13.4.19 In addition, HAWRAT has reported a number of alerts for outfalls where no pre-existing treatment has been identified. In the absence of mitigation for settlement of sediment; there could be an adverse impact on the water quality and biodiversity of the receiving watercourses and the downstream protected areas.

Importance

13.4.20 Table 13.8 shows the importance that has been assigned to each attribute of a water feature. Table 2 in Appendix A13.1 (Baseline Conditions) includes additional information about the indicators of quality that have been used to determine the importance of each attribute.

Table 13.8: Importance of Each Attribute of a Water Feature

Water Feature/SWF	Attribute	Importance
SWF 01 Inshes Burn	Hydrology and Flood Risk	Very high
	Fluvial geomorphology	Low
	Water quality/supply	High
	Dilution and removal of waste products	Low
	Biodiversity	Medium
SWF 02 Scretan Burn	Hydrology and Flood Risk	Very high
	Fluvial geomorphology	Medium
	Water quality/supply	High
	Dilution and removal of waste products	Low
	Biodiversity	Medium
SWF 03 Cairnlaw Burn	Hydrology and Flood Risk	Very high
	Fluvial geomorphology	Medium
	Water quality/supply	High
	Dilution and removal of waste products	Low
	Biodiversity	Very high
SWF 04 Tributary of Cairnlaw Burn (1)	Hydrology and Flood Risk	Very high
	Fluvial geomorphology	Medium
	Water quality/supply	High
	Dilution and removal of waste products	Low
	Biodiversity	Medium
SWF 05 Tributary of Cairnlaw Burn (2)	Hydrology and Flood Risk	Very high
	Fluvial geomorphology	Low
	Water quality/supply	High
	Dilution and removal of waste products	Low
	Biodiversity	High
SWF 06 Kenneth's Black Well	Hydrology and Flood Risk	Very high
	Fluvial geomorphology	Low
	Water quality/supply	High
	Dilution and removal of waste products	Medium
	Biodiversity	Medium
SWF 07 Drain at Allanfearn	Hydrology and Flood Risk	Very high
	Fluvial geomorphology	Low
	Water quality/supply	High

Water Feature/SWF	Attribute	Importance
	Dilution and removal of waste products	Low
	Biodiversity	Medium
SWF 08 Fiddler's Burn	Hydrology and Flood Risk	Very high
	Fluvial geomorphology	Low
	Water quality/supply	High
	Dilution and removal of waste products	Medium
	Biodiversity	Medium
SWF 09 Tributary of Rough Burn	Hydrology and Flood Risk	Very high
	Fluvial geomorphology	Low
	Water quality/supply	High
	Dilution and removal of waste products	Low
	Biodiversity	Medium
SWF 10 Indirect tributary of Rough Burn (1)	Hydrology and Flood Risk	Very high
SWF 11 Indirect tributary of Rough Burn (2)	Hydrology and Flood Risk	Very high
	Fluvial geomorphology	Low
	Water quality/supply	High
	Dilution and removal of waste products	Low
	Biodiversity	Medium
SWF 12 Rough Burn	Hydrology and Flood Risk	Very high
	Fluvial geomorphology	High
	Water quality/supply	High
	Dilution and removal of waste products	Low
	Biodiversity	Medium
SWF 13 Tributary of 'Unnamed Burn - Castle Stuart to source (Tornagrain)' (1)	Hydrology and Flood Risk	Very high
	Fluvial geomorphology	Low
	Water quality/supply	High
	Dilution and removal of waste products	Low
	Biodiversity	Medium
SWF 14 Unnamed Burn - Castle Stuart to source (Tornagrain)	Hydrology and Flood Risk	Very high
	Fluvial geomorphology	Low
	Water quality/supply	High
	Dilution and removal of waste products	Low
	Biodiversity	Medium
SWF 15 Tributary of 'Unnamed Burn - Castle Stuart to source (Tornagrain)' (2)	Hydrology and Flood Risk	Very high
	Fluvial geomorphology	Low
	Water quality/supply	High
	Dilution and removal of waste products	Low
	Biodiversity	Medium
SWF 16 Tributary of Ardersier Burn	Hydrology and Flood Risk	Very high
	Fluvial geomorphology	Low
	Water quality/supply	High
	Dilution and removal of waste products	Low
	Biodiversity	High
SWF 17 Drains at Culblair	Hydrology and Flood Risk	High
	Fluvial geomorphology	Low
	Water quality/supply	High
	Dilution and removal of waste products	Low
	Biodiversity	Medium
SWF 18 Indirect tributary drains of Ardersier Burn	Hydrology and Flood Risk	Very high
	Fluvial geomorphology	Low
	Water quality/supply	High
	Dilution and removal of waste products	Low

Water Feature/SWF	Attribute	Importance
	Biodiversity	Medium
SWF 19 Balnagowan Burn	Hydrology and Flood Risk	Very high
	Fluvial geomorphology	Low
	Water quality/supply	Medium
	Dilution and removal of waste products	Low
	Biodiversity	Low
SWF 21 Field ditch tributaries of Balnagowan Burn	Hydrology and Flood Risk	High
	Fluvial geomorphology	Low
	Water quality/supply	High
	Dilution and removal of waste products	Low
	Biodiversity	Medium
SWF 22 Alton Burn	Hydrology and Flood Risk	Very high
	Fluvial geomorphology	Low
	Water quality/supply	High
	Dilution and removal of waste products	Low
	Biodiversity	Medium
SWF 23 River Nairn	Hydrology and Flood Risk	Very high
	Fluvial geomorphology	Very high
	Water quality/supply	Very high
	Dilution and removal of waste products	Medium
	Biodiversity	Very high
SWF 24 Tributary of the River Nairn	Hydrology and Flood Risk	Very high
	Fluvial geomorphology	Low
	Water quality/supply	High
	Dilution and removal of waste products	Medium
	Biodiversity	Very high
SWF 26 Auldearn Burn	Hydrology and Flood Risk	Very high
	Fluvial geomorphology	Medium
	Water quality/supply	High
	Dilution and removal of waste products	Medium
	Biodiversity	Very high
SWF 31 Auldearn Burn - Brightmony Tributary	Hydrology and Flood Risk	Very high
	Fluvial geomorphology	Low
	Water quality/supply	High
	Dilution and removal of waste products	Medium
	Biodiversity	Medium
SWF 33 Drain at Penick Farm	Hydrology and Flood Risk	Very high
	Fluvial geomorphology	Low
	Water quality/supply	High
	Dilution and removal of waste products	Low
	Biodiversity	Medium
SWF 34 Tributary of Auldearn Burn (4)	Hydrology and Flood Risk	Very high
	Fluvial geomorphology	Low
	Water quality/supply	High
	Dilution and removal of waste products	Low
	Biodiversity	Medium
SWF 35 Drain, tributary of Auldearn Burn - Brightmony Tributary	Hydrology and Flood Risk	Low
	Fluvial geomorphology	Low
	Water quality/supply	High
	Dilution and removal of waste products	Low
	Biodiversity	Medium
Loch Flemington	Hydrology and Flood Risk	Very high
Ponds	Biodiversity	Low

13.5 Consultation

13.5.1 Details of the consultation process are provided in Chapter 6 (Consultation and Scoping). Consultations of particular relevance to this assessment were undertaken with regulatory bodies and key stakeholders.

13.5.2 Advice and guiding principles from SEPA has been taken into consideration during the design and assessment stages.

13.6 Impacts – Construction

13.6.1 An indicative construction programme, including the anticipated phasing of construction works, is provided in Chapter 4 (The Proposed Scheme) and Appendix A4.1 (Construction Information). Section 4.10 of Chapter 4 describes the construction of the carriageway drainage.

13.6.2 This section describes potential impacts on the water environment that could arise in the absence of mitigation, during the construction phase of the proposed Scheme. Residual impacts taking into account the proposed mitigation are provided in Section 13.9 (Residual Impacts) and Appendix A13.4 (Residual Impact Tables (Road Drainage and the Water Environment)). Details of the proposed Scheme are provided in Chapter 4 (The Proposed Scheme) and the key construction works on or near each water body are summarised in Table 13.10 and in Appendix A13.1 (Baseline Conditions) by SWF.

13.6.3 Generic potential impacts are described, followed by potential impacts on SWFs. Potential impacts on the water environment are described separately for each of the three specialist disciplines/attributes, as detailed in Section 13.3 (Methodology).

13.6.4 Construction impacts would generally be short-term. However, some potential construction impacts such as deposition of sediments can be longer-term. Construction impacts are likely to be more intense than during the long-term operational phase due to the heightened concentration of activities occurring in or near the SWFs.

Generic Construction Impacts

Hydrology and Flood Risk

13.6.5 Potential impacts during construction of the proposed Scheme could include soil compaction from works traffic, alteration of runoff pathways, dewatering of watercourses and increased flood risk.

13.6.6 Temporary haul roads may cause a temporary increase in runoff due to reduced infiltration rates in the area of the road.

13.6.7 Temporary discharge of working area drainage may also have an impact on the sediment regime of the receiving watercourse. During the construction phase, other temporary works that could affect surface hydrology and flood risk include the following:

- watercourse diversions to facilitate culvert and bridge construction may result in constrictions in conveyance; and
- runoff control measures (temporary, during works), which could include swales and geotextile-wrapped straw bale barriers.

13.6.8 The severity of the impacts is likely to be higher during periods of intense or prolonged rainfall. Construction materials and plant within the flood plain of watercourses may increase localised flood risk and could be damaged during a flood event. In addition, flood risk could be heightened by works in the flood plain, either constraining or resulting in a temporary loss of the existing flood plain.

Fluvial Geomorphology

13.6.9 Potential impacts during the construction phase mostly relate to suspended solids. In addition, weather conditions would also influence the severity of impacts. The majority of these impacts would worsen with intense or prolonged rainfall events during the construction phase.

13.6.10 Table 13.9 outlines potential generic impacts on the geomorphology during the construction of the proposed Scheme. The main potential impacts relate to an increase in fine sediment delivery, a reduction in morphological diversity and a change in natural fluvial processes of river channels.

Table 13.9: Potential Impacts on Geomorphology During the Construction Phase

Source of Impact	Potential Impacts
Suspended Solids	**Sediment Regime** A possible increase in water turbidity and siltation of channel substrate may occur. **Channel Morphology** A reduction in diversity of the channel bed due to smothering by fine sediment as a result of increased fine sediment supply. Loss of active features such as exposed gravel deposits due to smothering by fine sediment. Changes to the quantity of flow could potentially alter downstream fluvial dynamics and may cause alteration to erosion and deposition processes within a channel **Natural Fluvial Processes** Increased bare surfaces could result in changes to the quantity of flow entering the channel which has the potential to locally alter flow dynamics.
Vegetation Clearance	**Sediment Regime** An increase in supply of fine sediment through bank instability and increased exposed bare earth surfaces, particularly during the winter months. **Channel Morphology** Reduced morphological diversity due to loss of tree roots and/or woody debris. Woody debris within the channel can encourage the formation of different geomorphological features such as riffles, deposits and pools. In addition, smothering of the bed by silt as a result of increased fine sediment supply can cause a loss in the morphological diversity of the bed. **Natural Fluvial Processes** Vegetation clearance could reduce river bank stability, increasing the rates of erosion which could increase the rate at which channel changes shape in response to flow variation. Increased sediment delivery may impact on any sites of ecological importance located downstream.
Culvert Installation	**Sediment Regime** Installation would increase the volume of sediment directly entering the channel and consequently increase turbidity. **Channel Morphology** Channel bed would be disturbed or removed in the vicinity of the installation. **Natural Fluvial Processes** Planform change may be constrained at the site of culvert installation. Planform change may increase downstream, through erosion and deposition, due to increased sediment supply. The prevention of channel migration may have adverse consequences for both WFD targets and habitat diversity.
Channel Realignment	**Sediment Regime** An increase in sediment supply would occur during cutting a new course. A subsequent increase in channel erosion is likely if the channel is straightened and gradient is increased. Sediment may be introduced from accidental damage to river banks or watercourses resulting from plant movement or other construction activities. **Channel Morphology** Bedforms that have developed over a long period of time may be disturbed or destroyed. Without mitigation, the new channel would lack morphological diversity. The reduction of morphological diversity may have adverse consequences for both WFD targets and habitat diversity. **Natural Fluvial Processes** Channel instability may be triggered by straightening, particularly during high flows.

Source of Impact	Potential Impacts
Outfalls	**Sediment Regime** Installation could increase the volume of sediment directly entering the channel and consequently cause an increase in turbidity. **Channel Morphology** Construction activities could lead to localised modifications to the channel morphology although this is likely to be highly site-specific. **Natural Fluvial Processes** The stability of the river banks may be reduced during installation leading to the potential for higher rates of erosion. This is likely to be highly site-specific.
Clear Span Bridge	**Sediment Regime** Construction could increase the volume of sediment directly entering the channel and consequently increase turbidity. **Channel Morphology** Increased sediment delivery to the channel could smother substrate and increase local rates of erosion.

Water Quality

13.6.11 Although effects on water quality are likely to be short-term and acute during the construction phase, they could have a longer-term chronic effect on aquatic ecology and groundwater resources.

13.6.12 During the construction phase, pollution from mobilised suspended solids from construction sites would present the greatest risk to the water quality of watercourses. In particular, suspended solids found in construction site runoff can reduce the chemical or ecological quality of a watercourse. The effects of sedimentation can be felt at various locations along a river; for example, larger particles would be deposited on the stream bed closer to the source of pollution than finer sediments, which can be transported further and affect distant, downstream sections.

13.6.13 Runoff from construction sites can also contain toxic elements, which could have adverse effects on in-stream flora and fauna. Such toxic elements may build up on the stream bed and remain in situ for some time before they are degraded or dispersed. There would also be a risk from accidental spillage of fuels, lubricants and hydraulic fluids from mobile or stationary plant, which could potentially enter watercourses and cause acute pollution incidents.

13.6.14 Accidental release of concrete or unset cement into watercourses can result from the washings of plant and machinery or from a spill during concrete pouring. These materials are highly alkaline and if they enter surface waters or groundwater, have the potential to cause adverse effects on aquatic life through elevation of water pH.

13.6.15 Accidental/uncontrolled release of sewage from sewers through damage to pipelines during service diversion, or from on-site welfare facilities, can enter and pollute watercourses and groundwater.

13.6.16 Potential changes in groundwater levels associated with road cuttings could result in the dewatering of water features reducing downstream flows, which could result in adverse impacts on aquatic ecosystems. Refer to Chapter 12 (Geology, Soils, Contaminated Land and Groundwater) for further details regarding impacts to groundwater.

Specific Construction Impacts

13.6.17 This section provides an assessment of the potential construction impacts on each of the SWFs that remained scoped in. This is based on the key construction works proposed on or near each of the water bodies, as presented in Table 13.10 and shown on Figure 13.1. It should be noted that in all of the impact tables within this chapter and Appendix A13.4 (Residual Impact Tables), the impacts that are shown are adverse, unless otherwise stated. In addition, the potential construction impacts are temporary.

Table 13.10: Specific Construction Impacts from Construction Activities Within, Over and Near to SWFs (without Mitigation)

SWF	Construction Activities	Description of Specific Impact on SWF	Attribute	Importance	Magnitude	Significance
SWF 01 Inshes Burn	• Construction of dual carriageway alignment near SWF.	Hydrology and Flood Risk Potential for temporary increase in hardstanding areas and/or soil compaction during construction works to result in temporary increased runoff rates in to the water feature. Fluvial Geomorphology See Table 13.9 for generic impact of suspended solids. Additional fine sediment input has the potential to smother existing coarse gravel bed. Water Quality Potential for contaminated runoff, particularly silt, to drain to this SWF as a result of exposed surfaces and areas of new temporary and permanent hardstanding. In addition, there would be an increased risk of fine sediment and accidental spillages (fuels, chemicals and other hazardous substances) reaching this SWF during the construction works (none of which would be in-channel).	Hydrology and flood risk	Very high	Minor	Moderate
			Fluvial geomorphology	Low	Minor	Neutral
			Water quality/supply	High	Minor	Slight
			Dilution and removal of waste products	Low	Negligible	Neutral
			Biodiversity	Medium	Minor	Slight
SWF 02 Scretan Burn	• Construction of three outfalls (A, B and C). • Construction of one culvert (C02, approximately 66m in length) to replace existing culvert. • Construction of one channel realignment (approximately 250m in length). • Construction of dual carriageway	Hydrology and Flood Risk Temporary construction works for SUDS within catchment may slightly increase peak flow rates into watercourse. Temporary construction structures placed within flood risk zone or for flow diversion of the Scretan Burn may temporarily increase flood risk locally and be susceptible to flood damage. Potential for temporary increase in hardstanding areas and soil compaction during construction works to result in temporary increased runoff rates in to the water feature.	Hydrology and flood risk	Very high	Moderate	Large
			Fluvial geomorphology	Medium	Major	Large
			Water quality/supply	High	Major	Large
			Dilution and removal of waste products	Low	Moderate	Slight

SWF	Construction Activities	Description of Specific Impact on SWF	Attribute	Importance	Magnitude	Significance
	alignment over SWF. • Construction of SUDS near SWF.	Fluvial Geomorphology See Table 13.9 for generic impacts of suspended solids and construction of outfalls, culvert and realignment. Additional fine sediment input has the potential to smother existing cobble and gravel bed. Construction of structures and realignment would cause a disturbance to existing complex vegetated riparian zone and steep earth channel banks. Water Quality Potential for contaminated runoff, particularly silt, to drain to this SWF as a result of exposed surfaces and areas of new temporary and permanent hardstanding. In addition, there would be an increased risk of fine sediment and accidental spillages (fuels, chemicals and other hazardous substances) reaching the SWF during the proposed construction works, which include some in-channel works.	Biodiversity	Medium	Major	Large
SWF 03 Cairnlaw Burn	• Construction of two outfalls (D and E). • Construction of two culverts (C03, approximately 40m in length, and C04, approximately 60m in length) • Construction of two sections of realignment (approximately 83m and 490m in length). • Construction of dual carriageway alignment over SWF. • Construction of SUDS near SWF.	Hydrology and Flood Risk Temporary construction works for SUDS within catchment may slightly increase peak flow rates into watercourse. Temporary construction structures placed within flood risk zone or for flow diversion of the Cairnlaw Burn may temporarily increase flood risk locally and be susceptible to flood damage. Potential for temporary increase in hardstanding areas and soil compaction during construction works to result in temporary increased runoff rates in to the water feature. Fluvial Geomorphology See Table 13.9 for generic impacts of suspended solids and construction of outfalls, culverts and realignments. Additional fine sediment input has the potential to smother gravel bed; however, due to the presence of silt in several sections of the existing channel, this is unlikely to be significant. Construction of structures and realignments would cause a disturbance to existing semi-continuous vegetated riparian buffer and steep earth channel banks. Water Quality Refer to potential impacts described for SWF 02.	Hydrology and flood risk	Very high	Major	Very large
			Fluvial geomorphology	Medium	Moderate	Moderate
			Water quality/supply	High	Major	Large
			Dilution and removal of waste products	Low	Moderate	Slight
			Biodiversity	Very high	Major	Very large
SWF 04 Tributary of Cairnlaw Burn (1)	• Construction of dual carriageway alignment near SWF.	Hydrology and Flood Risk Potential for temporary increase in hardstanding areas and/or soil compaction during construction works to result in temporary increased runoff rates in to the water feature.	Hydrology and flood risk	Very high	Minor	Moderate
			Fluvial geomorphology	Medium	Minor	Slight

SWF	Construction Activities	Description of Specific Impact on SWF	Attribute	Importance	Magnitude	Significance
		Fluvial Geomorphology See Table 13.9 for generic impact of suspended solids. Additional fine sediment input has the potential to smother existing cobble and pebble bed. Water Quality Refer to potential impacts described for SWF 01.	Water quality/supply	High	Minor	Slight
			Dilution and removal of waste products	Low	Negligible	Neutral
			Biodiversity	Medium	Minor	Slight
SWF 05 Tributary of Cairnlaw Burn (2)	• Construction of one section of realignment (approximately 61m in length). • Construction of dual carriageway alignment over SWF. • Construction of SUDS near SWF.	Hydrology and Flood Risk Temporary structures placed within the flood risk zone as part of the watercourse realignment works for this water feature may temporarily increase flood risk locally and be susceptible to flood damage. Potential for temporary increase in hardstanding areas and/or soil compaction during construction works to result in temporary increased runoff rates in to the water feature. Fluvial Geomorphology See Table 13.9 for generic impacts of suspended solids and construction of realignment. Additional fine sediment input has the potential to smother existing gravel bed. Construction of realignment would cause a disturbance to existing woodland riparian zone, woodland floor and earth channel banks. Water Quality Refer to potential impacts described for SWF 02.	Hydrology and flood risk	Very high	Minor	Moderate
			Fluvial geomorphology	Low	Moderate	Slight
			Water quality/supply	High	Moderate	Moderate
			Dilution and removal of waste products	Low	Moderate	Slight
			Biodiversity	High	Moderate	Moderate
SWF 06 Kenneth's Black Well	• Construction of one outfall (F). • Construction of five new culverts (C05, approximately 54m in length, C26, approximately 88m in length, C27, approximately 10m in length, C29 approximately 6m in length, C30 approximately 24m in length). • Construction of two sections of realignment (approximately 217m and	Hydrology and Flood Risk Temporary construction works for SUDS within catchment may slightly increase peak flow rates into watercourse. Temporary construction structures placed within flood risk zone or for flow diversion of the water feature may temporarily increase flood risk locally and be susceptible to flood damage. Potential for temporary increase in hardstanding areas and soil compaction during construction works to result in temporary increased runoff rates in to the water feature.	Hydrology and flood risk	Very high	Major	Very large
			Fluvial geomorphology	Low	Moderate	Slight
			Water quality/supply	High	Major	Large
			Dilution and removal of waste products	Medium	Moderate	Moderate

SWF	Construction Activities	Description of Specific Impact on SWF	Attribute	Importance	Magnitude	Significance
	320m in length). • Construction of dual carriageway alignment over SWF.	Fluvial Geomorphology See Table 13.9 for impact of suspended solids and construction of outfall, culverts and realignments. Additional fine sediment input has the potential to smother imbricated cobble and gravel bed; however, due to the presence of silt in several sections of the existing channel, this is unlikely to be significant. Construction of structures and realignments would cause a disturbance to existing semi-continuous vegetated riparian buffer and steep earth (resectioned) channel banks. Water Quality Refer to potential impacts described for SWF 02.	Biodiversity	Medium	Major	Large
SWF 07 Drain at Allanfearn	• Construction of one new culvert (C06, approximately 90m in length). • Construction of two sections of realignment (approximately 205m and 200m in length). • Construction of dual carriageway alignment over SWF.	Hydrology and Flood Risk Temporary construction structures placed within flood risk zone or for flow diversion of the water feature may temporarily increase flood risk locally and be susceptible to flood damage. Potential for temporary increase in hardstanding areas and soil compaction during construction works to result in temporary increased runoff rates in to the water feature. Fluvial Geomorphology See Table 13.9 for generic impact of suspended solids and construction of culvert and realignments. Due to the existing presence of a silt bed, additional silt input is unlikely to be significant within SWF 07. Construction of structures and realignment would cause a disturbance to existing complex vegetated riparian buffer and steep earth (resectioned) channel banks. Water Quality Refer to potential impacts described for SWF 02.	Hydrology and flood risk	Very high	Moderate	Large
			Fluvial geomorphology	Low	Moderate	Slight
			Water quality/supply	High	Major	Large
			Dilution and removal of waste products	Low	Moderate	Slight
			Biodiversity	Medium	Major	Large
SWF 08 Fiddler's Burn	• Construction of one outfall (G) • Construction of one new culvert (C07, approximately 103m in length). • Construction of one section of realignment (approximately 190m in length). • Construction of dual carriageway alignment over SWF.	Hydrology and Flood Risk Temporary construction works for SUDS within catchment may slightly increase peak flow rates into watercourse. Temporary construction structures placed within flood risk zone or for flow diversion of the water feature may temporarily increase flood risk locally and be susceptible to flood damage. Potential for temporary increase in hardstanding areas and soil compaction during construction works to result in temporary increased runoff rates in to the water feature.	Hydrology and flood risk	Very high	Moderate	Large
			Fluvial geomorphology	Low	Moderate	Slight
			Water quality/supply	High	Major	Large
			Dilution and removal of waste products	Medium	Moderate	Moderate

SWF	Construction Activities	Description of Specific Impact on SWF	Attribute	Importance	Magnitude	Significance
	• Construction of SUDS near SWF.	Fluvial Geomorphology See Table 13.9 for generic impacts of suspended solids and construction of outfall, culvert and realignment. Additional fine sediment input has the potential to smother some sections of coarse gravel and pebble substrate; however, due to the dominance of silt within the channel, this impact is unlikely to be significant. Construction of structures and realignment would cause a disturbance to existing vegetated riparian buffer and steep earth (resectioned) channel banks. Water Quality Refer to potential impacts described for SWF 02.	Biodiversity	Medium	Major	Large
SWF 09 Tributary of Rough Burn	• Construction of two outfalls (H and I). • Construction of one new culvert (C08, approximately 48m in length). • Construction of dual carriageway alignment over SWF. • Construction of SUDS near SWF.	Hydrology and Flood Risk Temporary construction works for SUDS within catchment may slightly increase peak flow rates into watercourse. Temporary construction structures placed within flood risk zone or for flow diversion of the water feature may temporarily increase flood risk locally and be susceptible to flood damage. Potential for temporary increase in hardstanding areas and soil compaction during construction works to result in temporary increased runoff rates in to the water feature. Fluvial Geomorphology See Table 13.9 for generic impact of suspended solids and construction of outfalls and culvert. Additional fine sediment input has the potential to smother gravel and cobble substrate; however, due to the presence of silt in several sections of the existing channel, this is unlikely to be significant. Construction of structures would cause a disturbance to existing vegetated riparian buffer and steep earth (resectioned) channel banks. Water Quality Refer to potential impacts described for SWF 02.	Hydrology and flood risk	Very high	Moderate	Large
			Fluvial geomorphology	Low	Moderate	Slight
			Water quality/supply	High	Major	Large
			Dilution and removal of waste products	Low	Moderate	Slight
			Biodiversity	Medium	Major	Large
SWF 10 Indirect tributary of Rough Burn (1)	• No construction works within 100m.	Hydrology and Flood Risk No potential impacts identified for this water feature.	Hydrology and flood risk	Very high	Negligible	Neutral
SWF 11 Indirect tributary of Rough Burn (2)	• Construction of dual carriageway alignment near SWF.	Hydrology and Flood Risk Potential for temporary increase in hardstanding areas and/or soil compaction during construction works to result in temporary increased runoff rates in to the water feature.	Hydrology and flood risk	Very high	Minor	Moderate
			Fluvial geomorphology	Low	Minor	Neutral

SWF	Construction Activities	Description of Specific Impact on SWF	Attribute	Importance	Magnitude	Significance
		Fluvial Geomorphology See Table 13.9 for generic impacts of suspended solids. Additional fine sediment input has the potential to smother gravel and cobble substrate; however, due to the presence of silt in several sections of the existing channel, this is unlikely to be significant. Water Quality Refer to potential impacts described for SWF 01.	Water quality/supply	High	Minor	Slight
			Dilution and removal of waste products	Low	Negligible	Neutral
			Biodiversity	Medium	Minor	Slight
SWF 12 Rough Burn	• Construction of one new culvert (C09, approximately 74m in length). • Construction of one section of realignment (approximately 231m in length). • Construction of dual carriageway alignment over SWF.	Hydrology and Flood Risk Temporary construction structures placed within flood risk zone or for flow diversion of the water feature may temporarily increase flood risk locally and be susceptible to flood damage. Potential for temporary increase in hardstanding areas and soil compaction during construction works to result in temporary increased runoff rates in to the water feature. Fluvial Geomorphology See Table 13.9 for generic impacts of suspended solids and construction of culvert and realignment. Additional fine sediment input has the potential to smother existing gravel and cobble substrate at the crossing location. Construction of structures and realignment would cause a disturbance to existing complex vegetated riparian buffer, natural earth and cobble channel banks and existing step pool features within the channel. Water Quality Refer to potential impacts described for SWF 02.	Hydrology and flood risk	Very high	Major	Very large
			Fluvial geomorphology	High	Moderate	Moderate
			Water quality/supply	High	Moderate	Moderate
			Dilution and removal of waste products	Low	Minor	Neutral
			Biodiversity	Medium	Moderate	Moderate
SWF 13 Tributary of 'Unnamed Burn - Castle Stuart to source (Tornagrain)' (1)	• Construction of two outfalls (J and K). • Construction of one new culvert (C10, approximately 60m in length). • Construction of dual carriageway alignment over SWF. • Construction of SUDS near SWF.	Hydrology and Flood Risk Temporary construction works for SUDS within catchment may slightly increase peak flow rates into watercourse. Temporary construction structures placed within flood risk zone or for flow diversion of the water feature may temporarily increase flood risk locally and be susceptible to flood damage. Potential for temporary increase in hardstanding areas and soil compaction during construction works to result in temporary increased runoff rates in to the water feature.	Hydrology and flood risk	Very high	Moderate	Large
			Fluvial geomorphology	Low	Moderate	Slight
			Water quality/supply	High	Major	Large
			Dilution and removal of waste products	Low	Moderate	Slight

SWF	Construction Activities	Description of Specific Impact on SWF	Attribute	Importance	Magnitude	Significance
		Fluvial Geomorphology See Table 13.9 for generic impacts of suspended solids and construction of outfalls and culvert. Due to the existing presence of a silt bed, additional silt input is unlikely to be significant within SWF 13. Construction of structures would cause a disturbance to existing vegetated riparian buffer and steep, resectioned earth channel banks. Water Quality Refer to potential impacts described for SWF 02.	Biodiversity	Medium	Major	Large
SWF 14 Unnamed Burn - Castle Stuart to source (Tornagrain)	• Construction of one new culvert (C11, approximately 42m in length). • Construction of dual carriageway alignment over SWF.	Hydrology and Flood Risk Temporary construction structures placed within flood risk zone or for flow diversion of the water feature may temporarily increase flood risk locally and be susceptible to flood damage. Potential for temporary increase in hardstanding areas and soil compaction during construction works to result in temporary increased runoff rates in to the water feature. Fluvial Geomorphology See Table 13.9 for generic impacts of suspended solids and construction of culvert. Due to the existing presence of a silt bed, additional silt input is unlikely to be significant within SWF 14. Construction of structures would cause a disturbance to existing vegetated riparian buffer and steep, resectioned earth channel banks. Water Quality Refer to potential impacts described for SWF 02.	Hydrology and flood risk	Very high	Moderate	Large
			Fluvial geomorphology	Low	Moderate	Slight
			Water quality/supply	High	Moderate	Moderate
			Dilution and removal of waste products	Low	Minor	Neutral
			Biodiversity	Medium	Moderate	Moderate
SWF 15 Tributary of 'Unnamed Burn - Castle Stuart to source (Tornagrain)' (2)	• Construction of one new culvert (C12, approximately 64m in length). • Construction of dual carriageway alignment over SWF.	Hydrology and Flood Risk Temporary construction structures placed within flood risk zone or for flow diversion of the water feature may temporarily increase flood risk locally and be susceptible to flood damage. Potential for temporary increase in hardstanding areas and soil compaction during construction works to result in temporary increased runoff rates in to the water feature. Fluvial Geomorphology See Table 13.9 for generic impacts of suspended solids and	Hydrology and flood risk	Very high	Moderate	Large
			Fluvial geomorphology	Low	Moderate	Slight
			Water quality/supply	High	Moderate	Moderate
			Dilution and removal of waste products	Low	Minor	Neutral

SWF	Construction Activities	Description of Specific Impact on SWF	Attribute	Importance	Magnitude	Significance
		construction of culvert. Due to the existing presence of a silt bed, additional silt input is unlikely to be significant within SWF 15. Construction of structures would cause a disturbance to existing vegetated riparian buffer and steep, resectioned earth channel banks. Water Quality Refer to potential impacts described for SWF 02.	Biodiversity	Medium	Moderate	Moderate
SWF 16 Tributary of Ardersier Burn	• Construction of three outfalls (L, V and M). • Construction of two new culverts (C13, approximately 58m in length, and C14, approximately 40m in length). • Construction of one section of realignment (approximately 260m in length). • Construction of dual carriageway alignment over SWF. • Construction of SUDS near SWF.	Hydrology and Flood Risk Temporary construction works for SUDS within catchment may slightly increase peak flow rates into watercourse. Temporary construction structures placed within flood risk zone or for flow diversion of the water feature may temporarily increase flood risk locally and be susceptible to flood damage. Potential for temporary increase in hardstanding areas and soil compaction during construction works to result in temporary increased runoff rates in to the water feature. Fluvial Geomorphology See Table 13.9 for generic impact of suspended solids and construction of outfalls, culverts and realignment. Additional fine sediment input has the potential to smother gravel bed; however, due to the presence of silt in several sections of the existing channel, this is unlikely to be significant. Construction of structures and realignment would cause a disturbance to existing vegetated riparian buffer and steep, resectioned earth channel banks. Water Quality Refer to potential impacts described for SWF 02.	Hydrology and flood risk	Very high	Major	Very large
			Fluvial geomorphology	Low	Major	Moderate
			Water quality/supply	High	Major	Large
			Dilution and removal of waste products	Low	Moderate	Slight
			Biodiversity	High	Major	Large
SWF 17 Drains at Culblair	• Construction of two new culverts (C22, approximately 66m in length, and C31, approximately 12m in length). • Construction of dual carriageway alignment near SWF.	Hydrology and Flood Risk Potential for temporary increase in hardstanding areas and/or soil compaction during construction works to result in temporary increased runoff rates in to the water feature. Fluvial Geomorphology See Table 13.9 for generic impact of suspended solids and construction of culverts. Due to the existing artificial nature of SWF 17, additional sediment input to the channel is unlikely to be significant. Construction of structures would cause a disturbance to existing limited riparian buffer and steep, resectioned earth channel banks. Water Quality Refer to potential impacts described for SWF 02.	Hydrology and flood risk	High	Minor	Slight
			Fluvial geomorphology	Low	Moderate	Slight
			Water quality/supply	High	Minor	Slight
			Dilution and removal of waste products	Low	Negligible	Neutral
			Biodiversity	Medium	Minor	Slight

SWF	Construction Activities	Description of Specific Impact on SWF	Attribute	Importance	Magnitude	Significance
SWF 18 Indirect tributary drains of Ardersier Burn	• Construction of one outfall (N). • Construction of two new culverts (C15, approximately 56m in length, and C16, approximately 58m in length). • Construction of one section of realignment (approximately 310m in length). • Construction of dual carriageway alignment over SWF. • Construction of SUDS near SWF.	<u>Hydrology and Flood Risk</u> Temporary construction works for SUDS within catchment may slightly increase peak flow rates into watercourse. Temporary construction structures placed within flood risk zone or for flow diversion of the water feature may temporarily increase flood risk locally and be susceptible to flood damage. Potential for temporary increase in hardstanding areas and soil compaction during construction works to result in temporary increased runoff rates in to the water feature. <u>Fluvial Geomorphology</u> See Table 13.9 for generic impact of suspended solids and construction of outfall, culverts and realignment. Additional fine sediment input has the potential to smother some gravel deposits; however, due to the presence of silt in the majority of the existing channel, this is unlikely to be significant. Construction of structures and realignment would cause a disturbance to existing continuous vegetated riparian buffer and steep earth (resectioned) channel banks. <u>Water Quality</u> Refer to potential impacts described for SWF 02.	Hydrology and flood risk	Very high	Moderate	Large
			Fluvial geomorphology	Low	Moderate	Slight
			Water quality/supply	High	Major	Large
			Dilution and removal of waste products	Low	Moderate	Slight
			Biodiversity	Medium	Major	Large
SWF 19 Balnagowan Burn	• Construction of three outfalls (O, P and Q). • Construction of extension to SWF (approximately 150m in length). • Construction of two new culverts (C17, approximately 42m in length, and C23, approximately 14m in length). • Construction of dual carriageway alignment over SWF. • Construction of SUDS near SWF.	<u>Hydrology and Flood Risk</u> Temporary construction works for SUDS within catchment may slightly increase peak flow rates into watercourse. Temporary construction structures placed within flood risk zone or for flow diversion of the water feature may temporarily increase flood risk locally and be susceptible to flood damage. Potential for temporary increase in hardstanding areas and soil compaction during construction works to result in temporary increased runoff rates in to the water feature. <u>Fluvial Geomorphology</u> See Table 13.9 for generic impacts of suspended solids and construction of outfalls and culverts. Due to the existing presence of a silt bed, additional silt input is unlikely to be significant within SWF 19. Construction of structures would cause a disturbance to existing fragmented vegetated riparian buffer and steep earth (resectioned) channel banks. <u>Water Quality</u> Refer to potential impacts described for SWF 02.	Hydrology and flood risk	Very high	Moderate	Large
			Fluvial geomorphology	Low	Moderate	Slight
			Water quality/supply	Medium	Major	Large
			Dilution and removal of waste products	Low	Moderate	Slight
			Biodiversity	Low	Major	Slight

SWF	Construction Activities	Description of Specific Impact on SWF	Attribute	Importance	Magnitude	Significance
SWF 21 Field ditch tributaries of Balnagowan Burn	• Construction of dual carriageway alignment near SWF, including construction of embankment adjacent to SWF.	Hydrology and Flood Risk Potential for temporary increase in hardstanding areas and/or soil compaction during construction works to result in temporary increased runoff rates in to the water feature. Fluvial Geomorphology See Table 13.9 for generic impact of suspended solids. Water Quality Refer to potential impacts described for SWF 01.	Hydrology and flood risk	High	Minor	Slight
			Fluvial geomorphology	Low	Minor	Neutral
			Water quality/supply	High	Moderate	Moderate
			Dilution and removal of waste products	Low	Minor	Neutral
			Biodiversity	Medium	Minor	Slight
SWF 22 Alton Burn	• Construction of one outfall (R). • Construction of two new culverts (C18, approximately 127m in length, and C25, approximately 10m in length). • Construction of dual carriageway alignment over SWF.	Hydrology and Flood Risk Temporary construction works for SUDS within catchment may slightly increase peak flow rates into watercourse. Temporary construction structures placed within flood risk zone or for flow diversion of the water feature may temporarily increase flood risk locally and be susceptible to flood damage. Potential for temporary increase in hardstanding areas and soil compaction during construction works to result in temporary increased runoff rates in to the water feature. Fluvial Geomorphology See Table 13.9 for generic impacts of suspended solids and construction of outfall and culverts. Due to the existing presence of a silt bed, additional silt input is unlikely to be significant within SWF 22. Construction of structures would cause a disturbance to existing vegetated riparian buffer and steep, resectioned earth channel banks. Water Quality Refer to potential impacts described for SWF 02.	Hydrology and flood risk	Very high	Moderate	Large
			Fluvial geomorphology	Low	Moderate	Slight
			Water quality/supply	High	Moderate	Moderate
			Dilution and removal of waste products	Low	Minor	Neutral
			Biodiversity	Medium	Moderate	Moderate
SWF 23 River Nairn	• Construction of one outfall (S). • Construction of clear span bridge over SWF. • Construction of dual carriageway alignment over SWF.	Hydrology and Flood Risk Temporary construction works for SUDS within catchment may slightly increase peak flow rates into watercourse. This is unlikely to have a significant impact on the River Nairn as it is a large watercourse. Temporary construction structures placed within flood risk zone of the River Nairn may temporarily increase flood risk locally and be susceptible to flood damage. Potential for temporary increase in hardstanding areas and soil	Hydrology and flood risk	Very high	Moderate	Large
			Fluvial geomorphology	Very high	Moderate	Large
			Water quality/supply	Very high	Minor	Moderate
			Dilution and removal of waste products	Medium	Negligible	Neutral

SWF	Construction Activities	Description of Specific Impact on SWF	Attribute	Importance	Magnitude	Significance
		compaction during construction works to result in temporary increased runoff rates in to the water feature. Fluvial Geomorphology See Table 13.9 for generic impacts of suspended solids and construction of outfall and clear span bridge. Additional fine sediment input has the potential to smother cobble a pebble substrate. Construction of outfall and bridge would disturb existing woodland riparian zone and natural earth banks. Water Quality Refer to potential impacts described for SWF 02.	Biodiversity	Very high	Minor	Moderate
SWF 24 Tributary of the River Nairn	• Construction of two outfalls (T and U). • Construction of one new culvert (C19, approximately 52m in length). • Construction of dual carriageway alignment over SWF. • Construction of SUDS near SWF.	Hydrology and Flood Risk Temporary construction works for SUDS within catchment may slightly increase peak flow rates into watercourse. Temporary construction structures placed within flood risk zone or for flow diversion of the water feature may temporarily increase flood risk locally and be susceptible to flood damage. Potential for temporary increase in hardstanding areas and soil compaction during construction works to result in temporary increased runoff rates in to the water feature. Fluvial Geomorphology See Table 13.9 for generic impacts of suspended solids and construction of outfalls and culvert. Additional fine sediment input has the potential to smother gravel and pebble substrate; however, due to the presence of silt in several sections of the existing channel, this is unlikely to be significant. Construction of structures would cause a disturbance to existing earth channel banks and existing riffle features within the channel. Water Quality Refer to potential impacts described for SWF 02.	Hydrology and flood risk	Very high	Moderate	Large
			Fluvial geomorphology	Low	Moderate	Slight
			Water quality/supply	High	Major	Large
			Dilution and removal of waste products	Medium	Moderate	Moderate
			Biodiversity	Very high	Major	Very large
SWF 26 Auldearn Burn	• Construction of three outfalls (W, X and Y). • Construction of one new culvert (C20, approximately 48m in length). • Construction of one section of realignment (approximately 157m in length). • Construction of dual carriageway alignment over SWF.	Hydrology and Flood Risk Temporary construction works for SUDS within catchment may slightly increase peak flow rates into watercourse. Temporary construction structures placed within flood risk zone or for flow diversion of the water feature may temporarily increase flood risk locally and be susceptible to flood damage. Potential for temporary increase in hardstanding areas and soil compaction during construction works to result in temporary increased runoff rates in to the water feature.	Hydrology and flood risk	Very high	Major	Very large
			Fluvial geomorphology	Medium	Major	Large
			Water quality/supply	High	Major	Large
			Dilution and removal of waste products	Medium	Minor	Slight

SWF	Construction Activities	Description of Specific Impact on SWF	Attribute	Importance	Magnitude	Significance
	• Construction of SUDS near SWF.	Fluvial Geomorphology See Table 13.9 for generic impacts of suspended solids and construction of outfalls, culvert and realignment. Additional fine sediment input has the potential to smother existing gravel and cobble substrate at the crossing location. Construction of structures and realignment would cause a disturbance to existing fragmented vegetated riparian buffer, natural earth and cobble channel banks and existing gravel bar features within the channel. Water Quality Refer to potential impacts described for SWF 02.	Biodiversity	Very high	Major	Very large
SWF 31 Auldearn Burn - Brightmony Tributary	• Construction of dual carriageway alignment approximately 80m from SWF.	Hydrology and Flood Risk Potential for temporary increase in hardstanding areas and/or soil compaction during construction works to result in temporary increased runoff rates in to the water feature. Fluvial Geomorphology See Table 13.9 for generic impacts of suspended solids. Due to the existing presence of a silt bed, additional silt input is unlikely to be significant within SWF 31. Water Quality Refer to potential impacts described for SWF 01.	Hydrology and flood risk	Very high	Minor	Moderate
			Fluvial geomorphology	Low	Minor	Neutral
			Water quality/supply	High	Negligible	Neutral
			Dilution and removal of waste products	Medium	Negligible	Neutral
			Biodiversity	Medium	Negligible	Neutral
SWF 33 Drain at Penick Farm	• Construction of dual carriageway alignment near SWF.	Hydrology and Flood Risk Potential for temporary increase in hardstanding areas and/or soil compaction during construction works to result in temporary increased runoff rates in to the water feature. Fluvial Geomorphology See Table 13.9 for generic impacts of suspended solids. Due to the existing presence of a silt bed, additional silt input is unlikely to be significant within SWF 33. Water Quality Refer to potential impacts described for SWF 01.	Hydrology and flood risk	Very high	Minor	Moderate
			Fluvial geomorphology	Low	Minor	Neutral
			Water quality/supply	High	Minor	Slight
			Dilution and removal of waste products	Low	Negligible	Neutral
			Biodiversity	Medium	Minor	Slight
SWF 34 Tributary of Auldearn Burn (4)	• Construction of dual carriageway alignment and watercourse realignment (SWF 26) near SWF.	Hydrology and Flood Risk No potential impacts identified for this water feature. Fluvial Geomorphology See Table 13.9 for generic impacts of suspended solids. Additional fine sediment input has the potential to smother gravel and cobble substrate within SWF 34 at this location.	Hydrology and flood risk	Very high	Negligible	Neutral
			Fluvial geomorphology	Low	Minor	Neutral
			Water quality/supply	High	Minor	Slight

SWF	Construction Activities	Description of Specific Impact on SWF	Attribute	Importance	Magnitude	Significance
		Water Quality Refer to potential impacts described for SWF 01.	Dilution and removal of waste products	Low	Negligible	Neutral
			Biodiversity	Medium	Minor	Slight
SWF 35 Drain, tributary of Auldearn Burn - Brightmony Tributary	• Construction of one outfall (Z). • Construction of dual carriageway alignment over 100m from SWF.	Hydrology and Flood Risk Temporary construction works for SUDS within catchment may slightly increase peak flow rates into watercourse. Potential for temporary increase in hardstanding areas and soil compaction during construction works to result in temporary increased runoff rates in to the water feature. Fluvial Geomorphology See Table 13.9 for impact of suspended solids and construction of outfall. Due to the existing presence of a silt bed, additional silt input is unlikely to be significant within SWF 36. Construction of an outfall would cause a disturbance to existing complex vegetated riparian buffer and steep, resectioned earth channel banks. Water Quality Refer to potential impacts described for SWF 02.	Hydrology and flood risk	Low	Minor	Neutral
			Fluvial geomorphology	Low	Moderate	Slight
			Water quality/supply	High	Minor	Slight
			Dilution and removal of waste products	Low	Negligible	Neutral
			Biodiversity	Medium	Minor	Slight
Ponds	• Construction of dual carriageway alignment within 100m of some of the ponds. • Loss of Pond 25.1 and Pond 25.2 under footprint of Scheme.	Water Quality Change in water quality due to construction of the dual carriageway alignment. Increased risk of accidental spillages (fuels, chemicals and other hazardous substances) reaching ponds during the proposed construction works.	Biodiversity	Low	Moderate	Slight

13.7 Impacts – Operation

13.7.1 This section describes potential impacts on the water environment that could arise in the absence of mitigation, during the operational phase of the proposed Scheme. Residual impacts taking into account the proposed mitigation are provided in Section 13.10 (Summary) and Appendix A13.4 (Residual Impact Tables (Road Drainage and the Water Environment)).

13.7.2 Generic potential impacts are described, followed by specific impacts on water features. Potential impacts on the water environment are described separately for each of the three specialist disciplines/attributes, as detailed in Section 13.3 (Methodology). The results of the HAWRAT water quality assessment are presented in Tables 13.14 to 13.16, and 13.21 to 13.23, under the water quality section for specific operational impacts.

13.7.3 Operational impacts are generally long-term or permanent and would influence the SWFs after the proposed Scheme is complete.

Generic Operational Impacts

Hydrology and Flood Risk

13.7.4 The following aspects of road development may have a permanent impact on the localised water environment along the proposed Scheme route:

- Impermeable areas: impermeable areas increase the overall volume of water reaching the watercourse, as less is lost to infiltration. Road runoff may also reach the receiving watercourse earlier than pre-proposed Scheme conditions which may result in the flood response of the catchment becoming more ‘flashy’, increasing flood risk and stream power downstream.
- Discharge of road drainage: road drainage would drain to an outfall discharging to a receiving watercourse. Alterations to the hydrological and flood regimes of receiving watercourses may occur if there is no suitably designed attenuation of surface water runoff.
- Reduced catchment: constriction or severing of established flow paths may lead to an increased flood risk; changes to sediment regime via changes to gradient and size of watercourse leading to impacts upon geomorphology and subsequently water quality. Alterations to the flow regime could also have associated impacts on the ecological status of a watercourse.
- Pre-earthworks drainage: prior to construction, it would be necessary to construct a pre-earthworks drainage system to prepare the work corridor. At this stage any small watercourses or catchment areas identified as suitable are incorporated into the pre-earthworks drainage system. The drainage system would remain in place throughout the operation of the proposed Scheme and can result in permanent re-direction of discharge for affected watercourses. Catchment areas could increase or decrease depending on the outfall point of the pre-earthworks drainage system and where appropriate this is taken into account in the specific impact assessments.
- Flood plain storage capacity can be reduced if embankments or other structures are built within the flood plain. The reduced storage of flood water passes additional water downstream where it could potentially have an adverse negative impact.
- Earthworks partially spanning a flood plain can cause a constraint in the movement of flood waters along the flood plain and result in increased flooding upstream.
- Alteration to, or the construction of, culverts (or bridges) can affect flow carrying capacity of a channel. Imposing a constriction would potentially result in high flood levels upstream. Conversely opening up a culvert could worsen the flood risk downstream if it acted as a flood retention structure.

Fluvial Geomorphology

13.7.5 Table 13.11 outlines potential generic impacts on the geomorphology during the operation of the proposed Scheme.

Table 13.11: Potential Impacts on Geomorphology during the Operation Phase

Source of Impact	Potential Impacts
Increased Impervious Surfaces	**Sediment Regime** Potential for changed sediment regime due to increased runoff and areas of erosion. **Channel Morphology** Increased runoff from the proposed Scheme could potentially cause increase in erosion downstream of the proposed Scheme. **Natural Fluvial Processes** Potential for increase in runoff from the proposed Scheme which could locally alter flow regime within the channel.
Culvert	**Sediment Regime** Localised impact to sediment regime caused by increased flow velocities and decreased roughness within the culvert. Additional sediment supply from potentially eroding banks and bed caused by the structure. Deposition within the culvert during low flows. **Channel Morphology** A permanent crossing in the form of a culvert would remove the natural channel bed and banks within the particular location, creating a uniform artificial channel. Locally altered flow patterns have the potential to create areas of erosion and/or deposition upstream and/or downstream of the structure. **Natural Fluvial Processes** Lateral and longitudinal connectivity would be impacted within the immediate location of the culvert. Alteration of flow patterns due to the uniform, artificial channel.
Channel Realignment (including SWF extension)	**Sediment Regime** Realignment or extension of a watercourse would have potential to either reduce or increase the length of a channel, directly altering the gradient and changing sediment processes. Realignment could provide a beneficial impact with opportunity for improved transportation of sediment and encouragement of natural fluvial processes. **Channel Morphology** Changes in flow regime and sediment processes caused by channel realignment or extension could alter the morphology of the channel. In some cases disruption to the channel morphology would be short-term and realignment may actually improve the channel morphology. Along historically modified (engineered) channels, realignment may offer an opportunity to restore/rehabilitate the watercourse. **Natural Fluvial Processes** Realignment or extension of a watercourse would have potential to either reduce or increase the length of a channel, directly altering the gradient and changing flow and sediment transport dynamics. Realignment would also provide an opportunity to increase flow dynamics within a watercourse.
Outfalls	**Sediment Regime** Increased discharge into the channel has the potential to locally alter sediment regime (e.g. increased flow velocity could remove a layer of fine sediment from the channel substrate). Potential increase in scour caused by the structure or change in flow patterns could provide a supply of sediment to the water feature. **Channel Morphology** Outfall would potentially replace a small section of natural channel bank and bed and encourage downstream erosion. **Natural Fluvial Processes** Additional discharge to the channel would have the potential to locally alter flow patterns. Outfall headwall structure also has the potential to locally alter flow patterns, particularly if protruding into the channel.
Clear Span Bridge (no in-channel piers)	**Natural Fluvial Processes** Potential impact on riparian which could inhibit lateral connectivity with the flood plain.

Water Quality

13.7.6 Once the road is opened to traffic, it could lead to adverse impacts on the water environment, if appropriate mitigation measures were not incorporated into the design.

13.7.7 There are a wide range of pollutants found in road runoff which may have an effect on the receiving waters and associated ecology, including suspended solids and contaminants bound to them (such as metals and phosphorus); biodegradable organic materials (such as debris and grass cuttings); diffuse sources with high levels of nutrients (nitrogen and phosphorus); de-icing salt (chloride); and oil and related compounds. Pollutants may reach SWFs through discharges of routine runoff from the proposed Scheme or from accidental spillages.

13.7.8 New or extended culverts could potentially change the riverbed morphological diversity and sediment regime of a watercourse and this could have an associated effect on water quality by mobilising suspended solids and releasing previously 'locked' contaminants into the water column.

13.7.9 New or extended culverts may also have an effect on water quality due to oxygen sags caused by the lack of light, which restricts aquatic plant photosynthesis, and rapid microbiological degradation of biodegradable matter. Structures that are relatively wide and/or short in length would tend to allow better light penetration and therefore have a lower effect on water quality. Any reduction in surface area through culverts would also likely reduce atmospheric oxygenation of the water.

13.7.10 Channel realignments could potentially change the sediment regime of a watercourse, resulting in increased effects of erosion or deposition, and this could have an associated effect on water quality by mobilising suspended solids and releasing previously 'locked' contaminants into the water column. Changes in turbulence can also affect atmospheric oxygenation of the water.

Specific Operational Impacts

13.7.11 This section provides an assessment of the potential operational impacts on each SWF that has remained 'scoped in' to the assessment, in the absence of mitigation.

13.7.12 Twenty-six new drainage outfalls are proposed to discharge to 14 SWFs during the operational phase, as summarised in Table 13.12.

13.7.13 Drainage Catchment O was originally proposed to discharge to groundwater via an infiltration basin. However, the GI determined that it would not be feasible for an infiltration basin in this location. The routine runoff from this catchment would now be piped from the pond in an easterly direction, before passing beneath the Highland Main Line, travelling northwards along one field boundary and discharging into SWF 19. SWF 19 will be extended westwards, along one field boundary to accommodate this outfall.

Table 13.12: Proposed Scheme Drainage Network

Outfall	Receiving Water Body	Approximate Impermeable Road Drainage Area (ha)
A	SWF 02	0.89
B	SWF 02	1.15
C	SWF 02	2.68
D	SWF 03	1.43
E	SWF 03	1.27
F	SWF 06	4.30
G	SWF 08	2.26
H	SWF 09	2.80
I	SWF 09	2.28
J	SWF 13	1.66
K	SWF 13	0.76
L	SWF 16	2.65
V	SWF 16	2.83
M	SWF 16	3.81
N	SWF 18	4.00
O	SWF 19	3.88

Outfall	Receiving Water Body	Approximate Impermeable Road Drainage Area (ha)
P	SWF 19	1.40
Q	SWF 19	6.00
R	SWF 22	2.66
S	SWF 23	3.83
T	SWF 24	2.24
U	SWF 24	5.15
W	SWF 26	1.90
X	SWF 26	1.72
Y	SWF 26	2.96
Z	SWF 35	4.97

Hydrology and Flood Risk and Fluvial Geomorphology

13.7.14 The specific operational impacts for hydrology and flood risk and fluvial geomorphology are presented in Table 13.13. These impacts are based on the proposed route of the road and structures on or near each of the water bodies.

13.7.15 The specific operational impacts for water quality are presented separately, after the results of the Step 2 HAWRAT routine runoff assessment, which follows Table 13.13.

Table 13.13: Specific Operational Impacts from the Proposed Route of the Road or Proposed Structures Within, Over and Near to SWFs (without Mitigation)

Water Body	Operational Feature	Description of Specific Impact on Water Body	Attribute	Importance	Magnitude	Significance
SWF 01 Inshes Burn	• Increased impervious surfaces due to carriageway near SWF.	Hydrology and Flood Risk The proposed Scheme would introduce no modifications of significance to the hydrology and flood risk of SWF 01. Fluvial Geomorphology See Table 13.11 for generic impacts of increased impervious surfaces. Additional runoff and fine sediment input from the road has the potential to smother existing coarse gravel bed and locally change flow dynamics.	Hydrology and flood risk	Very high	Negligible	Neutral
			Fluvial geomorphology	Low	Minor	Neutral
SWF 02 Scretan Burn	• Three outfalls (A, B and C). • One new culvert (C02, approximately 66m in length). • One channel realignment (approximately 250m in length). • Increased impervious surfaces due to carriageway over/near SWF.	Hydrology and Flood Risk Three road drainage outfalls discharge to SWF 02. The impact on hydrology has been assessed as Negligible. Modifications of significance to flood risk: (1) removal of Ashton Farm access road culvert; (2) realignment of watercourse; (3) construction of new culvert to accommodate road widening; and (4) possible loss of flood storage due to road construction. The extended culvert carrying the proposed dual carriageway alignment has been designed to pass the design flow with headwater level contained within the banks. . Upstream channel flow has also been assessed as staying within the watercourse banks. Fluvial Geomorphology See Table 13.11 for generic impacts of increased impervious surfaces, outfalls, culvert and realignment. Additional runoff and fine sediment input from the road has the potential to smother existing cobble and gravel bed and locally change flow dynamics. Structures and realignment would permanently remove existing complex vegetated riparian zone, steep earth channel banks and a section of cobble and gravel bed. The outfalls also have the potential to locally impact the smooth and rippled flow type. The removal of the Ashton Farm culvert would provide some mitigation for the works by returning a section of enclosed channel into an open channel alignment.	Hydrology and flood risk	Very high	Negligible	Neutral
			Fluvial geomorphology	Medium	Major	Large
SWF 03 Cairnlaw Burn	• Two outfalls (D and E). • Two new culverts (C03, approximately 40m in length, and C04, approximately 60m in length). • Two channel realignments	Hydrology and Flood Risk Two road drainage outfall discharges to SWF 03.The impact on hydrology has been assessed as Negligible. Modifications of significance to flood risk: (1) Barn Church Road (C1032) culvert to be replaced with C03; (2) realignment of watercourse; (3) construction of new culverts to accommodate the	Hydrology and flood risk	Very high	Major	Very Large
			Fluvial geomorphology	Medium	Moderate	Moderate

Water Body	Operational Feature	Description of Specific Impact on Water Body	Attribute	Importance	Magnitude	Significance
	(approximately 83m and 490m in length). • Increased impervious surfaces due to carriageway over/near SWF.	new dual carriageway alignment immediately upstream of existing A96 crossing; and (4) possible loss of flood storage due to road construction. Post development conditions for this water feature have been assessed using the numerical hydraulic model developed during baseline study to determine any changes in the flow conditions and flood extents under the design 0.5%AEP (200-year) plus climate change flow. The proposed Scheme would result in an increase in flood levels and increased flood flows affecting the Milton of Culloden railway underpass, and a loss of existing floodplain. Fluvial Geomorphology See Table 13.11 for generic impacts of increased impervious surfaces, outfalls, culverts and realignments. Additional runoff and fine sediment input from the road has the potential to smother existing gravel bed and locally change flow dynamics. Structures and realignments would permanently remove existing vegetated riparian zone, steep earth channel banks and a large section of gravel bed. The outfalls also have the potential to locally impact the pool-riffle flow type.				
SWF 04 Tributary of Cairnlaw Burn (1)	• Increased impervious surfaces due to carriageway over/near SWF.	Hydrology and Flood Risk The proposed Scheme would introduce no modifications of significance to the hydrology and flood risk of SWF 04. Fluvial Geomorphology See Table 13.11 for generic impacts of increased impervious surfaces. Additional runoff and fine sediment input from the road has the potential to smother existing cobble and pebble bed and locally change flow dynamics.	Hydrology and flood risk	Very high	Negligible	Neutral
			Fluvial geomorphology	Medium	Minor	Slight
SWF 05 Tributary of Cairnlaw Burn (2)	• One channel realignment (approximately 61m in length). • Increased impervious surfaces due to carriageway near SWF.	Hydrology and Flood Risk The proposed Scheme would introduce no modifications of significance to the hydrology and flood risk of SWF 05. Fluvial Geomorphology See Table 13.11 for generic impacts of increased impervious surfaces, outfall and realignment. Additional runoff and fine sediment input from the road has the potential to smother existing gravel bed and locally change flow dynamics. Realignment would permanently remove existing woodland riparian zone, woodland floor and earth channel banks.	Hydrology and flood risk	Very high	Negligible	Neutral
			Fluvial geomorphology	Low	Moderate	Slight
SWF 06	• One outfall (F).	Hydrology and Flood Risk One road drainage outfall discharges to SWF 06. The impact on	Hydrology and flood risk	Very high	Major	Very large

Water Body	Operational Feature	Description of Specific Impact on Water Body	Attribute	Importance	Magnitude	Significance
Kenneth's Black Well	• Five new culverts (C05, approximately 54m in length, C26, approximately 88m in length, C27, approximately 10m in length, C29 approximately 6m in length, C30 approximately 24m in length). • Two channel realignments (approximately 217m and 320m in length). • Increased impervious surfaces due to carriageway over/near SWF.	hydrology has been assessed as Negligible Modifications of significance to flood risk: (1) realignment of watercourse; (2) construction of new culverts to accommodate new dual carriageway alignment immediately upstream of existing A96 crossing; and (3) possible loss of flood storage due to road construction. Post development conditions for this water feature have been assessed using the numerical hydraulic model developed during the baseline assessment to determine any changes in the flow conditions and flood extents under the design 0.5% AEP (200-year) plus climate change flow. The impacts of the proposed Scheme include a loss of floodplain, and increased flood depths in close proximity to the proposed Scheme and a number of receptors. <u>Fluvial Geomorphology</u> See Table 13.11 for generic impacts of increased impervious surfaces, outfall, culvert and realignment. Additional runoff and fine sediment input from the road has the potential to smother existing cobble and gravel bed; however, due to the presence of silt in several sections of the existing channel. Additional runoff could also locally change flow dynamics. Structures and realignments would permanently remove existing semi-continuous vegetated riparian buffer and steep earth (resectioned) channel banks and a section of gravel bed. The outfalls also have the potential to locally impact the pool-riffle flow type.	Fluvial geomorphology	Low	Moderate	Slight
SWF 07 Drain at Allanfearn	• One new culvert (C06, approximately 90m in length). • Two channel realignments (approximately 205m and 200m in length). • Increased impervious surfaces due to carriageway over/near SWF.	<u>Hydrology and Flood Risk</u> Modifications of significance to flood risk: (1) realignment of watercourse; (2) construction of new culvert to accommodate the new dual carriageway alignment; and (3) possible loss of flood storage due to road construction. The proposed Scheme would not alter the hydrology or flood risk of SWF 07. <u>Fluvial Geomorphology</u> See Table 13.11 for generic impacts of increased impervious surfaces, culvert and realignment. Due to the existing presence of a silt bed, additional silt input from increased runoff from the road is unlikely to be significant within SWF 07. Additional runoff has the potential to locally change flow dynamics. The culvert and realignment would permanently remove existing complex vegetated riparian zone, steep earth channel banks and a section of natural bed.	Hydrology and flood risk	Very high	Negligible	Neutral
			Fluvial geomorphology	Low	Moderate	Slight

Water Body	Operational Feature	Description of Specific Impact on Water Body	Attribute	Importance	Magnitude	Significance
SWF 08 Fiddler's Burn	• One outfall (G) • One new culvert (C07, approximately 103m in length). • One channel realignment (approximately 190m in length). • Increased impervious surfaces due to carriageway over/near SWF.	Hydrology and Flood Risk One road drainage outfall discharges to SWF 08. The impact on hydrology has been assessed as Negligible Modifications of significance to flood risk: (1) realignment of watercourse; (2) construction of new culvert to accommodate the new dual carriageway alignment; and (3) possible loss of flood storage due to road construction. The proposed new culvert has been sized to pass the design flow, plus appropriate freeboard. The sizing has been calculated to allow in-bank flow conditions upstream. Fluvial Geomorphology See Table 13.11 for generic impacts of increased impervious surfaces, outfall, culvert and realignment. Additional runoff and fine sediment input from the road has the potential to smother sections of coarse gravel and pebble bed and locally change flow dynamics. Structures and realignment would permanently remove existing complex vegetated riparian zone, steep earth channel banks and a section of gravel and pebble bed. The outfall also has the potential to locally impact the rippled flow type.	Hydrology and flood risk	Very high	Negligible	Neutral
			Fluvial geomorphology	Low	Moderate	Slight
SWF 09 Tributary of Rough Burn	• Two outfalls (H and I). • One new culvert (C08, approximately 48m in length). • Increased impervious surfaces due to carriageway over/near SWF.	Hydrology and Flood Risk Two road drainage outfalls discharge to SWF 09. The impact on hydrology has been assessed as Negligible Modifications of significance to flood risk: (1) construction of new culvert to accommodate the new dual carriageway alignment; and (2) possible loss of flood storage due to road construction. The proposed new culvert has been sized to pass the design flow, plus appropriate freeboard. The sizing has been calculated to allow in-bank flow conditions upstream. The proposed Scheme would encroach into floodplain between it and the existing A96, causing an increase in flood levels by 0.363m Fluvial Geomorphology See Table 13.11 for impact of increased impervious surfaces, outfalls and culvert. Additional runoff and fine sediment input from the road has the potential to smother sections of gravel and cobble bed and locally change flow dynamics. The culvert would permanently remove existing vegetated riparian zone, steep earth channel banks and a section of gravel and cobble bed. The outfalls also have the potential to locally impact the flow conditions.	Hydrology and flood risk	Very high	Major	Very large
			Fluvial geomorphology	Low	Moderate	Slight

Water Body	Operational Feature	Description of Specific Impact on Water Body	Attribute	Importance	Magnitude	Significance
SWF 10 Indirect tributary of Rough Burn (1)	• No construction works within 100m.	Hydrology and Flood Risk As there is no direct impact from the proposed Scheme on this watercourse, assessment is limited to consideration of upstream propagation of water levels due to modifications to SWF 09 downstream of the confluence.	Hydrology and flood risk	Very high	Negligible	Neutral
SWF 11 Indirect tributary of Rough Burn (2)	• Increased impervious surfaces due to carriageway near SWF.	Hydrology and Flood Risk As there is no direct impact from the proposed Scheme on this watercourse, assessment is limited to consideration of upstream propagation of water levels due to modifications to SWF 09 downstream of the confluence. Fluvial Geomorphology See Table 13.11 for impact of increased impervious surfaces. Additional runoff and fine sediment input from the road has the potential to smother existing cobble and gravel bed and locally change flow dynamics.	Hydrology and flood risk	Very high	Negligible	Neutral
			Fluvial geomorphology	Low	Minor	Neutral
SWF 12 Rough Burn	• One new culvert (C09, approximately 74m in length). • One channel realignment (approximately 231m in length). • Increased impervious surfaces due to carriageway over/near SWF.	Hydrology and Flood Risk Modifications of significance to flood risk: (1) channel realignment; (2) construction of new culvert to accommodate the new dual carriageway alignment; and (3) possible loss of flood storage due to road construction. Post development conditions for this water feature have been assessed using the numerical hydraulic model developed during baseline study to determine any changes in the flow conditions and flood extents under the design 0.5%AEP (200-year) plus climate change flow. Without mitigation the proposed Scheme would impede overland flow route for flood water, increasing downstream flows. Fluvial Geomorphology See Table 13.11 for impact of increased impervious surfaces, culvert and realignment. Additional runoff and fine sediment input from the road has the potential to smother sections of coarse gravel and cobble bed and locally change flow dynamics. Structure and realignment would permanently remove existing complex vegetated riparian zone, steep and vertical earth channel banks and a section of gravel and cobble bed. The structures and realignment may also remove flow features including step-pool and pool-riffle sequences, rippled flow and freefall.	Hydrology and flood risk	Very high	Major	Very large
			Fluvial geomorphology	High	Moderate	Moderate

Water Body	Operational Feature	Description of Specific Impact on Water Body	Attribute	Importance	Magnitude	Significance
SWF 13 Tributary of 'Unnamed Burn - Castle Stuart to source (Tornagrain)' (1)	• Two outfalls (J and K). • One new culvert (C10, approximately 60m in length). • Increased impervious surfaces due to carriageway over/near SWF.	Hydrology and Flood Risk Two road drainage outfalls discharge to SWF 13. The impact on hydrology has been assessed as Negligible Modifications of significance to flood risk: (1) construction of new culvert to accommodate the new dual carriageway alignment; and (2) possible loss of flood storage due to road construction. The proposed new culvert has been sized to pass the design flow, plus appropriate freeboard. Fluvial Geomorphology See Table 13.11 for impact of increased impervious surfaces, outfalls and culvert. Additional runoff and fine sediment input from the road has the potential increase siltation. The culvert would permanently remove the existing vegetated riparian zone, earth banks and a section channel bed. The outfalls also have the potential to locally impact the flow conditions.	Hydrology and flood risk	Very high	Negligible	Neutral
			Fluvial geomorphology	Low	Moderate	Slight
SWF 14 Unnamed Burn - Castle Stuart to source (Tornagrain)	• One new culvert (C11, approximately 42m in length). • Increased impervious surfaces due to carriageway over/ near SWF.	Hydrology and Flood Risk Modifications of significance to flood risk: (1) construction of new culvert to accommodate the new dual carriageway alignment; and (2) possible loss of flood storage due to road construction. The proposed new culvert has been sized to pass the design flow, plus appropriate freeboard. Fluvial Geomorphology See Table 13.11 for impact of increased impervious surfaces and culvert. Additional runoff and fine sediment input from the road has the potential to increase siltation of his channel. The culvert would permanently remove existing vegetated riparian zone, earth banks and a section of channel bed.	Hydrology and flood risk	Very high	Negligible	Neutral
			Fluvial geomorphology	Low	Moderate	Slight
SWF 15 Tributary of 'Unnamed Burn - Castle Stuart to source (Tornagrain)' (2)	• One new culvert (C12, approximately 64m in length). • Increased impervious surfaces due to carriageway over/near SWF.	Hydrology and Flood Risk Modifications of significance to flood risk: (1) construction of new culvert to accommodate the new dual carriageway alignment; and (2) possible loss of flood storage due to road construction. The DMRB Stage 3 Assessment is based on the 0.018m increase in water levels within the floodplain adjacent to the proposed Scheme, a minor magnitude impact. This is an impact of Moderate significance if judged against the proposed Scheme, but the baseline condition does not feature the proposed scheme, and the change is only experienced by the woodland area, which is of low sensitivity, resulting in an impact of Neutral significance.	Hydrology and flood risk	Very high	Negligible	Neutral
			Fluvial geomorphology	Low	Moderate	Slight

Water Body	Operational Feature	Description of Specific Impact on Water Body	Attribute	Importance	Magnitude	Significance
		Fluvial Geomorphology See Table 13.11 for impact of increased impervious surfaces and culvert. Additional runoff and fine sediment input from the road has the potential to increase siltation of his channel and smother gravels. The culvert would permanently remove existing vegetated riparian zone, earth banks and a section of gravel bed. The culvert may also impact on flow types.				
SWF 16 Tributary of Ardersier Burn	• Three outfalls (L, V and M). • Two new culverts (C13, approximately 58m in length). • One channel realignment (approximately 260m in length, and C14, approximately 40m in length). • Increased impervious surfaces due to carriageway over/near SWF.	Hydrology and Flood Risk Three road drainage outfalls discharge to SWF 16. The impact on hydrology has been assessed as Minor Modifications of significance to flood risk: (1) channel realignment; (2) construction of two new culverts to accommodate the new dual carriageway alignment; and (3) possible loss of flood storage due to road construction. Post development conditions for this water feature have been assessed using the numerical hydraulic model developed during baseline study to determine any changes in the flow conditions and flood extents under the design 0.5%AEP (200-year) plus climate change flow. Without mitigation the proposed Scheme would intercept an overland flow route for flood water which would increase flood risk to the Aberdeen to Inverness railway and Inverness airport, and present flood risk to the proposed Scheme. Fluvial Geomorphology See Table 13.11 for impact of increased impervious surfaces, outfalls, culverts and realignment. Additional runoff and fine sediment input from the road has the potential to smother sections of fine and coarse gravels, cobbles and pebble substrate and locally change flow dynamics. Structures and realignment would permanently remove existing complex vegetated riparian zone, earth channel banks and a section of gravel, cobble and pebble bed. The outfalls and culverts also have the potential to locally impact the rippled flow type.	Hydrology and flood risk	Very high	Major	Very large
			Fluvial geomorphology	Low	Major	Moderate
SWF 17 Drains at Culblair	• Two new culverts (C22, approximately 66m in length, and C31, approximately 12m in length). • Increased impervious surfaces due to carriageway near SWF.	Hydrology and Flood Risk Modifications of significance to flood risk: (1) construction of two new culverts to accommodate the new dual carriageway alignment; and (2) possible loss of flood storage due to road construction. The proposed new culverts carrying the dualled A96 alignment have been sized to pass the design flow, plus appropriate freeboard without impact on upstream flood risk.	Hydrology and flood risk	High	Negligible	Neutral
			Fluvial geomorphology	Low	Moderate	Slight

Water Body	Operational Feature	Description of Specific Impact on Water Body	Attribute	Importance	Magnitude	Significance
		Fluvial Geomorphology See Table 13.11 for impact of increased impervious surfaces and culverts. Additional runoff and fine sediment input from the road has the potential to increase siltation of his channel. The culverts would permanently remove existing limited riparian zone, earth banks and a section of the bed. The culverts would also impact on the smooth flow type.				
SWF 18 Indirect tributary drains of Ardersier Burn	• One outfall (N). • Two new culverts (C15, approximately 56m in length, and C16, approximately 58m in length). • One channel realignment (approximately 310m in length). • Increased impervious surfaces due to carriageway over/near SWF.	Hydrology and Flood Risk One road drainage outfall discharges to SWF 18. The impact on hydrology has been assessed as Negligible Modifications of significance to flood risk: (1) channel realignment; (2) construction of two new culverts (one each on the main drain and a tributary) to accommodate the new dual carriageway alignment; and (3) possible loss of flood storage due to road construction. The two new culverts whereby the proposed new alignment would cross SWF 18 and a tributary are sized with sufficient capacity to pass the design flow with water levels remaining in bank. Fluvial Geomorphology See Table 13.11 for impact of increased impervious surfaces, outfall, culverts and realignment. Additional runoff and fine sediment input from the road has the potential to smother sections of cobble, pebble and gravel bed and locally change flow dynamics. Structures and realignment would permanently remove existing complex vegetated riparian zone, earth channel banks and a section of gravel, cobble and pebble bed. The culverts and realignment may also remove flow diversity, including step-pool sequence, riffle-pool sequence, rippled and smooth flow. The outfall also has the potential to locally impact the rippled flow type.	Hydrology and flood risk	Very high	Negligible	Neutral
			Fluvial geomorphology	Low	Moderate	Slight
SWF 19 Balnagowan Burn	• Three outfalls (O, P and Q). • Two new culverts (C17, approximately 42m in length, and C23, approximately 14m in length). • Increased impervious surfaces due to carriageway over/near SWF.	Hydrology and Flood Risk Three road drainage outfalls discharge to SWF 19. The impact on hydrology has been assessed as Negligible Modifications of significance to flood risk: (1) construction of two new culverts to accommodate the new dual carriageway alignment and a field access over the watercourse; and (2) possible loss of flood storage due to road construction. Fluvial Geomorphology See Table 13.11 for impact of increased impervious surfaces, outfalls and culvert. Additional runoff and fine sediment input from the road has the potential to increase siltation of the channel. Structures would permanently remove existing vegetated riparian	Hydrology and flood risk	Very high	Negligible	Neutral
			Fluvial geomorphology	Low	Moderate	Slight

Water Body	Operational Feature	Description of Specific Impact on Water Body	Attribute	Importance	Magnitude	Significance
		zone and earth channel banks. The culverts and outfalls may also alter flow types locally.				
SWF 21 Field ditch tributaries of Balnagowan Burn	• Increased impervious surfaces due to carriageway near SWF.	Hydrology and Flood Risk The proposed Scheme would introduce no modifications of significance to the hydrology and flood risk of SWF 21. Fluvial Geomorphology See Table 13.11 for impact of increased impervious surfaces. Additional runoff and fine sediment input from the road has the potential to increase siltation of his channel.	Hydrology and flood risk	High	Negligible	Neutral
			Fluvial geomorphology	Low	Minor	Neutral
SWF 22 Alton Burn	• One outfall (R). • Two new culverts (C18, approximately 127m in length, and C25, approximately 10m in length). • Increased impervious surfaces due to carriageway over/near SWF.	Hydrology and Flood Risk One road drainage outfall discharges to SWF 22. The impact on hydrology has been assessed as Negligible. Modifications of significance to flood risk: (1) construction of two new culverts to accommodate the new dual carriageway alignment and an adjacent new local access road; and (3) possible loss of flood storage due to road construction. Under baseline conditions and the 0.5% AEP (200-year) plus climate change design flow, results indicate that the new culverts crossing SWF 22 are sized with sufficient capacity to pass the design flow with water levels remaining in bank. Fluvial Geomorphology See Table 13.11 for impact of increased impervious surfaces, outfall and culvert. Additional runoff and fine sediment input from the road has the potential to increase siltation of his channel. Structures and realignment would permanently remove existing riparian zone and earth banks. The culverts and outfall may also remove/alter the rippled flow type.	Hydrology and flood risk	Very high	Negligible	Neutral
			Fluvial geomorphology	Low	Moderate	Slight
SWF 23 River Nairn	• One outfall (S). • One clear span bridge. • Increased impervious surfaces due to carriageway over/near SWF.	Hydrology and Flood Risk One road drainage outfall discharges to SWF 23. The impact on hydrology has been assessed as Negligible Modifications of significance to flood risk: (1) construction of a new bridge spanning the river; and (2) possible loss of flood storage due to road construction. In order to assess the impact of the proposed Scheme on flood risk from the River Nairn, numerical hydraulic modelling has been undertaken to consider the post development case. Model results indicate negligible change in water levels on the River Nairn (and flood plain) due to the introduction of the new bridge and approach earthworks.	Hydrology and flood risk	Very high	Negligible	Neutral
			Fluvial geomorphology	Very high	Moderate	Large

Water Body	Operational Feature	Description of Specific Impact on Water Body	Attribute	Importance	Magnitude	Significance
		Fluvial Geomorphology See Table 13.11 for impact of increased impervious surfaces, outfall and clear span bridge. Additional runoff and fine sediment input from the road has the potential to smother sections of cobble and pebble substrate. The outfall has the potential to locally impact the varied flow types, which include rippled, pool-riffle and smooth flow.				
SWF 24 Tributary of the River Nairn	• Two outfalls (T and U). • One new culvert (C19, approximately 52m in length). • Increased impervious surfaces due to carriageway near SWF.	Hydrology and Flood Risk Two road drainage outfalls discharge to SWF 24. The impact on hydrology has been assessed as Minor Modifications of significance to flood risk: (1) construction of a new culvert to accommodate the new dual carriageway alignment; and (2) possible loss of flood storage due to road construction. The proposed new culvert would be sized to pass the design flow, plus appropriate freeboard. The initial sizing has been calculated to allow in-bank flow conditions upstream. Fluvial Geomorphology See Table 13.11 for impact of increased impervious surfaces, outfalls and culvert. Additional runoff and fine sediment input from the road has the potential to smother sections of pebble and gravel bed. The culvert would permanently remove earth channel banks and a section of pebble and gravel bed and alter flow dynamics. The outfalls also have the potential to locally impact the rippled flow type.	Hydrology and flood risk	Very high	Negligible	Neutral
			Fluvial geomorphology	Low	Moderate	Slight
SWF 26 Auldearn Burn	• Three outfalls (W, X and Y). • One new culvert (C20, approximately 48m in length). • One channel realignment (approximately 157m in length). • Increased impervious surfaces due to carriageway over/near SWF.	Hydrology and Flood Risk Three road drainage outfalls discharge to SWF 26. The impact on hydrology has been assessed as Minor Modifications of significance to flood risk: (1) channel realignment; (2) construction of a new culvert to accommodate the new dual carriageway alignment; and (3) possible loss of flood storage due to road construction. Post development conditions for this water feature have been assessed using the numerical hydraulic model developed during baseline study to determine any changes in the flow conditions and flood extents under the design 0.5%AEP (200-year) plus climate change flow. Without mitigation the proposed Scheme would encroach into flood plain although the proposed culvert is appropriately sized to pass the full flow. This results in localised increase in flood depths. Fluvial Geomorphology See Table 13.11 for impact of increased impervious surfaces, outfalls, culverts and realignment. Additional runoff and fine	Hydrology and flood risk	Very high	Moderate	Large
			Fluvial geomorphology	Medium	Major	Large

Water Body	Operational Feature	Description of Specific Impact on Water Body	Attribute	Importance	Magnitude	Significance
		sediment input from the road has the potential to smother sections of pebble and gravel bed. Structures and realignment would permanently remove existing riparian zone, earth channel banks and a section of gravel and pebble bed. The outfalls, culvert and realignment may also impact on the rippled flow type.				
SWF 31 Auldearn Burn - Brightmony Tributary	• Increased impervious surfaces due to carriageway near SWF.	Hydrology and Flood Risk SWF 31 has been included in the numerical model representing SWF 26, to capture effects of the proposed Scheme (which crosses SWF 26 downstream of the SWF 26/31 confluence) propagating upstream into the SWF 31 catchment. Fluvial Geomorphology See Table 13.11 for impact of increased impervious surfaces. Additional runoff and fine sediment input from the road has the potential to increase siltation of his channel.	Hydrology and flood risk	Very high	Negligible	Neutral
			Fluvial geomorphology	Low	Minor	Neutral
SWF 33 Drain at Penick Farm	• Increased impervious surfaces due to carriageway near SWF.	Hydrology and Flood Risk The proposed Scheme would introduce no modifications of significance to the hydrology and flood risk of SWF 33. Fluvial Geomorphology See Table 13.11 for impact of increased impervious surfaces. Additional runoff and fine sediment input from the road has the potential to increase siltation of his channel.	Hydrology and flood risk	Very high	Negligible	Neutral
			Fluvial geomorphology	Low	Minor	Neutral
SWF 34 Tributary of Auldearn Burn (4)	• Increased impervious surfaces due to carriageway near SWF.	Hydrology and Flood Risk SWF 34 has been included in the numerical model representing SWF 26, to capture effects of the proposed Scheme (which crosses SWF 26 downstream of the SWF 26/34 confluence) propagating upstream into the SWF 34 catchment. Fluvial Geomorphology See Table 13.11 for generic impacts of increased impervious surfaces. Additional runoff and fine sediment input from the road has the potential to smother existing cobble and pebble bed and locally change flow dynamics.	Hydrology and flood risk	Very high	Negligible	Neutral
			Fluvial geomorphology	Low	Minor	Neutral
SWF 35 Drain, tributary of Auldearn Burn - Brightmony Tributary	• One outfall (Z). • Increased impervious surfaces due to carriageway near SWF.	Hydrology and Flood Risk One road drainage outfall discharges to SWF 35. The impact on hydrology has been assessed as Major Fluvial Geomorphology See Table 13.11 for impact of increased impervious surfaces and outfall. Additional runoff and fine sediment input from the road has the potential to increase siltation of his channel. The outfall may also impact on the flow types.	Hydrology and flood risk	Low	Negligible	Neutral
			Fluvial geomorphology	Low	Moderate	Slight

Water Quality

HAWRAT Routine Runoff Assessment Results (without Mitigation)

13.7.16 The HAWRAT routine runoff assessment has been completed for the drainage catchments along the dual carriageway alignment, as all of these drainage catchments are proposed to discharge to surface water. The detailed results of the HAWRAT routine runoff assessment can be found in Appendix A13.3 (Water Quality Calculations).

13.7.17 Individual (single outfall) routine runoff assessments have been completed for all of the proposed outfalls. In addition, cumulative routine runoff assessments have been undertaken where two or more outfalls discharge into the same reach of a SWF. There are two types of cumulative routine runoff assessment, as follows:

- A cumulative assessment for soluble and sediment-bound pollutants is required when two or more outfalls are located within 100m of each other in the same reach of a SWF.
- A cumulative assessment for soluble pollutants is required when two or more outfalls are located over 100m from each other, but within 1km, in the same reach of a SWF.

13.7.18 All of the proposed outfalls into a SWF failed Step 1 of the individual and cumulative assessments, as would normally be expected. Therefore, Step 2, Tier 1 assessments were completed for all of the outfalls. The results of these assessments are shown in Tables 13.14 to 13.16.

13.7.19 The outfalls that failed the Step 2, Tier 1 assessments for soluble acute and/or sediment chronic impacts were then taken forward to Step 3, which considers the residual impacts following mitigation. The results of the Step 3 assessments can be found in Section 13.9 (Residual Impacts), in Tables 13.21 to 13.23.

13.7.20 Step 2, Tier 2 assessments have also been undertaken for those outfalls that failed the HAWRAT Step 3 assessment with the level of mitigation required by SEPA. The results of these assessments are shown in Tables 13.14 to 13.15.

13.7.21 Table 13.14 summarises the results of the Step 2 individual HAWRAT routine runoff assessments for soluble and sediment-bound pollutants.

13.7.22 Table 13.15 summarises the results of the Step 2 cumulative HAWRAT routine runoff assessments for soluble and sediment-bound pollutants.

13.7.23 Table 13.16 summarises the results of the Step 2 cumulative routine runoff assessments for soluble impacts.

Table 13.14: Summary of Step 2 HAWRAT Individual Routine Runoff Assessment (Do Something)

Drainage Catchment/Outfall	Tier	Receiving Watercourse	HAWRAT Results		Compliance with Environmental Quality Standards
			Soluble Acute Impacts	Sediment Chronic Impacts	
A	Tier 1	SWF 02	Pass	Alert 1[1]	Pass
B	Tier 1	SWF 02	Pass	Alert 3	Pass
C	Tier 1	SWF 02	Pass	Alert 3	Pass
D	Tier 1	SWF 03	Pass	Alert 3	Pass
E	Tier 1	SWF 03	Pass	Alert 3	Pass
F	Tier 1	SWF 06	**Fail**	**Fail**	Pass
G	Tier 1	SWF 08	**Fail**	Alert 2	Pass
H	Tier 1	SWF 09	Pass	**Fail**	Pass

[1] Alerts are described in Section 13.3 (Methodology), paragraphs 13.2.57 and 13.2.58.

Drainage Catchment/Outfall	Tier	Receiving Watercourse	HAWRAT Results		Compliance with Environmental Quality Standards
			Soluble Acute Impacts	Sediment Chronic Impacts	
I	Tier 1	SWF 09	Pass	**Fail**	Pass
J	Tier 1	SWF 13	**Fail**	**Fail**	Pass
K	Tier 1	SWF 13	Pass	**Fail**	Pass
L	Tier 1	SWF 16	Pass	Alert 2	Pass
V	Tier 1	SWF 16	Pass	Alert 2	Pass
M	Tier 1	SWF 16	Pass	Alert 2	Pass
N	Tier 1	SWF 18	Pass	**Fail**	Pass
O	Tier 1	SWF 19	**Fail**	**Fail**	**Fail**
O	Tier 2	SWF 19	**Fail**	**Fail**	**Fail**
P	Tier 1	SWF 19	Pass	Alert 2	Pass
Q	Tier 1	SWF 19	**Fail**	**Fail**	Pass
R	Tier 1	SWF 22	Pass	Pass	Pass
S	Tier 1	SWF 23	Pass	Alert 1	Pass
T	Tier 1	SWF 24	**Fail**	**Fail**	Pass
U	Tier 1	SWF 24	**Fail**	**Fail**	**Fail**
W	Tier 1	SWF 26	Pass	Alert 1	Pass
X	Tier 1	SWF 26	Pass	Alert 3	Pass
Y	Tier 1	SWF 26	Pass	Alert 3	Pass
Z	Tier 1	SWF 35	**Fail**	**Fail**	Pass

Table 13.15: Summary of Step 2 HAWRAT Cumulative Routine Runoff Assessment for Soluble and Sediment Impacts (Do Something)

Drainage Catchment/Outfall	Tier	Receiving Watercourse	HAWRAT Results		Compliance with Environmental Quality Standards
			Soluble Acute Impacts	Sediment Chronic Impacts	
B & C	Tier 1	SWF 02	**Fail**	Alert 3	Pass
D & E	Tier 1	SWF 03	Pass	**Fail**	Pass
H & I	Tier 1	SWF 09	**Fail**	**Fail**	Pass
H & I	Tier 2	SWF 09	**Fail**	Alert 1	Pass
L,V & M	Tier 1	SWF 16	**Fail**	Alert 2	Pass
P & Q	Tier 1	SWF 19	**Fail**	**Fail**	**Fail**
P & Q	Tier 2	SWF 19	**Fail**	Alert 2	**Fail**
T & U	Tier 1	SWF 24	**Fail**	**Fail**	**Fail**
X & Y	Tier 1	SWF 26	Pass	Alert 3	Pass

Table 13.16: Summary of Step 2 HAWRAT Cumulative Routine Runoff Assessment for Soluble Impacts (Do Something)

Drainage Catchment/Outfall	Receiving Watercourse	HAWRAT Results Soluble Acute Impacts	Compliance with Environmental Quality Standards
A, B & C	SWF 02	**Fail**	Pass
J & K	SWF 13	**Fail**	Pass

Assessment of Pollution Impacts from Spillages

13.7.24 The risk of an accidental spillage or vehicle fire, which could lead to a pollution incident, is considered to be proportional to the risk of a collision of heavy goods vehicles. Not all spillages lead to pollution incidents, as action can be taken to control spillages and prevent them from affecting the water environment.

13.7.25 The results of the spillage risk assessment are shown in Appendix A13.3 (Water Quality Calculations). The assessment has been completed for both individual outfalls and for outfalls discharging into the same reach (assessment of cumulative risk). The results show that the risk of a serious pollution incident for each outfall (including the cumulative risk where more than one outfall discharges into the same reach) has an annual probability far below the 1% quoted in DMRB HD45/09 for outfalls that are not within 1km of a protected area and the 0.5% quoted in the guidance for outfalls that are within 1km of a protected area. Therefore the assessment has identified that no measures are required to mitigate spillage risk. In addition the proposed Scheme would be designed to modern highway codes and standards, which would also reduce the likelihood of such an accident.

13.7.26 Table 13.17 describes the specific operational impacts on water quality attributes in the absence of mitigation. It should be noted that where an outfall has passed the assessment for soluble pollutants but received an 'Alert' for sediment-bound pollutants, the potential magnitude of impact for the attributes 'biodiversity' and 'water quality/supply' is shown as minor adverse, not negligible. This is to highlight that there could be a potential impact if no mitigation was provided for settlement of sediments.

Table 13.17: Specific Operational Impacts on Water Quality Attributes (without Mitigation)

Water Body	Operational Feature	Description of Specific Impact on Water Quality	Attribute	Importance	Magnitude	Significance
SWF 02 Scretan Burn	Three outfalls (A, B and C)	Outfalls A, B and C passed their Step 2, Tier 1 individual assessments for both soluble pollutants and sediment-bound pollutants (latter with an Alert) and the assessment against EQSs. Outfalls A, B and C failed the Step 2, Tier 1 cumulative assessment for soluble pollutants, but passed the assessment against EQSs. Outfalls B and C passed the Step 2, Tier 1 cumulative assessment for sediment-bound pollutants (with an Alert 3) and the assessment against EQSs, but failed the assessment for soluble pollutants.	Water quality/supply	High	Minor	Moderate
			Dilution and removal of waste products	Low	Negligible	Neutral
			Biodiversity	Medium	Minor	Slight
SWF 03 Cairnlaw Burn	Two outfalls (D and E)	Outfalls D and E passed their Step 2, Tier 1 individual assessments for soluble pollutants, sediment-bound pollutants (latter with Alert 3) and the assessment against EQSs. Outfalls D and E passed the Step 2, Tier 1 cumulative assessment for soluble pollutants and the assessment against EQSs, but failed the assessment for sediment-bound pollutants.	Water quality/supply	High	Minor	Moderate
			Dilution and removal of waste products	Low	Negligible	Neutral
			Biodiversity	Very high	Minor	Moderate
SWF 06 Kenneth's Black Well	One outfall (F)	Outfall F failed the Step 2, Tier 1 individual assessment for both soluble pollutants and sediment-bound pollutants; however, it passed the assessment against EQSs.	Water quality/supply	High	Moderate	Large
			Dilution and removal of waste products	Medium	Negligible	Neutral
			Biodiversity	Medium	Moderate	Moderate
SWF 08 Fiddler's Burn	One outfall (G)	Outfall G passed the Step 2, Tier 1 individual assessment for sediment-bound pollutants (with an Alert 2) and the assessment against EQSs, but failed the assessment for soluble pollutants.	Water quality/supply	High	Minor	Moderate
			Dilution and removal of waste products	Medium	Negligible	Neutral
			Biodiversity	Medium	Minor	Slight

Water Body	Operational Feature	Description of Specific Impact on Water Quality	Attribute	Importance	Magnitude	Significance
SWF 09 Tributary of Rough Burn	Two outfalls (H and I)	Outfalls H and I passed their Step 2, Tier 1 individual assessments for soluble pollutants and the assessment against EQSs, but failed the assessment for sediment-bound pollutants. Outfalls H and I failed the Step 2, Tier 1 cumulative assessment for soluble pollutants and sediment-bound pollutants (with Alert 2), but passed the assessment against EQSs. Outfalls H and I failed the Step 2, Tier 2 cumulative assessment for soluble pollutants, but passed the assessment for sediment-bound pollutants (with Alert 2) and the assessment against EQSs.	Water quality/supply	High	Moderate	Large
			Dilution and removal of waste products	Low	Negligible	Neutral
			Biodiversity	Medium	Moderate	Moderate
SWF 13 Tributary of 'Unnamed Burn - Castle Stuart to source (Tornagrain)' (1)	Two outfalls (J and K)	Outfall J failed the Step 2, Tier 1 individual assessment for both soluble pollutants and sediment-bound pollutants. Outfall K passed the Step 2, Tier 1 individual assessment for soluble pollutants, but failed the assessment for sediment-bound pollutants. Both outfalls passed the assessment against EQSs. Outfalls J and K failed the Step 2, Tier 1 cumulative assessment for soluble pollutants, but passed the assessment against EQSs.	Water quality/supply	High	Moderate	Large
			Dilution and removal of waste products	Low	Minor	Neutral
			Biodiversity	Medium	Moderate	Moderate
SWF 16 Tributary of Ardersier Burn	Three outfalls (L, V and M)	All three outfalls passed their Step 2, Tier 1 individual assessments for soluble pollutants and sediment-bound pollutants (latter with Alert 2). All three outfalls also passed the assessment against EQSs. Outfalls L, V and M passed the Step 2, Tier 1 cumulative assessment for sediment-bound pollutants and the assessment against EQSs, but failed the assessment for soluble pollutants.	Water quality/supply	High	Minor	Moderate
			Dilution and removal of waste products	Low	Negligible	Neutral
			Biodiversity	High	Minor	Moderate
SWF 18 Indirect tributary drains of Ardersier Burn	One outfall (N)	Outfall N passed the Step 2, Tier 1 individual assessment for soluble pollutants and the assessment against EQSs; however, it failed the assessment for sediment-bound pollutants.	Water quality/supply	High	Minor	Moderate
			Dilution and removal of waste products	Low	Negligible	Neutral
			Biodiversity	Medium	Minor	Slight

Water Body	Operational Feature	Description of Specific Impact on Water Quality	Attribute	Importance	Magnitude	Significance
SWF 19 Balnagowan Burn	Three outfalls (O, P and Q)	Outfall O failed the Step 2, Tier 1 and 2 individual assessments for soluble pollutants and sediment-bound pollutants and failed the assessment against EQSs. Outfall P passed the Step 2, Tier 1 individual assessment for soluble pollutants and sediment-bound pollutants (latter with Alert 2) and the assessment against EQSs. Outfall Q failed the Step 2, Tier 1 individual assessment for soluble pollutants and sediment-bound pollutants; however, it has passed the assessment against EQSs. Outfalls P and Q failed the Step 2, Tier 1 cumulative assessment for soluble pollutants, sediment-bound pollutants (with an Alert 2) and the assessment against EQSs. Outfalls P and Q failed the Step 2, Tier 2 cumulative assessment for soluble pollutants and the assessment against EQSs, but passed the assessment for sediment-bound pollutants (latter with Alert 2).	Water quality/supply	Medium	Major	Large
			Dilution and removal of waste products	Low	Minor	Neutral
			Biodiversity	Low	Major	Moderate
SWF 22 Alton Burn	One outfall (R)	Outfall R passed the Step 2, Tier 1 individual assessment for soluble and sediment-bound pollutants and the assessment against EQSs.	Water quality/supply	High	Negligible	Neutral
			Dilution and removal of waste products	Low	Negligible	Neutral
			Biodiversity	Medium	Negligible	Neutral
SWF 23 River Nairn	One outfall (S)	Outfall S passed the Step 2, Tier 1 individual assessment for soluble and sediment-bound pollutants (latter with Alert 1) and the assessment against EQSs.	Water quality/supply	Very high	Negligible	Neutral
			Dilution and removal of waste products	Medium	Negligible	Neutral
			Biodiversity	Very high	Minor	Moderate
SWF 24 Tributary of the River Nairn	Two outfalls (T and U)	Outfall T failed the Step 2, Tier 1 individual assessment for soluble and sediment-bound pollutants, but passed the assessment against EQSs. Outfall U failed the Step 2, Tier 1 individual assessment for soluble and sediment-bound pollutants and the assessment against EQSs.	Water quality/supply	High	Major	Very Large
			Dilution and removal of waste products	Medium	Minor	Slight

Water Body	Operational Feature	Description of Specific Impact on Water Quality	Attribute	Importance	Magnitude	Significance
		Outfalls T and U failed the Step 2, Tier 1 cumulative assessment for both soluble and sediment-bound pollutants and the assessment against EQSs.	Biodiversity	Very high	Major	Very Large
SWF 26 Auldearn Burn	Three outfalls (W, X and Y)	All three outfalls passed their respective Step 2, Tier 1 individual assessments for soluble and sediment-bound pollutants (latter with Alerts) and the assessment against EQSs. Outfalls X and Y passed the Step 2, Tier 1 cumulative assessment for both soluble and sediment-bound pollutants (latter with Alert 3) and the assessment against EQSs.	Water quality/supply	High	Minor	Moderate
			Dilution and removal of waste products	Medium	Negligible	Neutral
			Biodiversity	Very high	Minor	Moderate
SWF 35 Drain, tributary of Auldearn Burn - Brightmony Tributary	One outfall (Z)	Outfall Z failed the Step 2, Tier 1 individual assessment for soluble and sediment-bound pollutants, but passed the assessment against EQSs.	Water quality/supply	High	Moderate	Large
			Dilution and removal of waste products	Low	Minor	Neutral
			Biodiversity	Medium	Moderate	Moderate

13.8 Mitigation

13.8.1 Mitigation measures for the proposed Scheme in relation to road drainage and the water environment are detailed below and take into account best practice, legislation, guidance and professional experience. The mitigation commitments identified in the SEAs for the STPR (Jacobs, Faber Maunsell, Grant Thompson and Tribal Consulting 2008) and A96 Dualling Programme (CH2M 2015 and 2016) have also been taken into consideration.

13.8.2 The objectives of the mitigation measures outlined in this section are to avoid/prevent, reduce or offset the potential impacts described in Section 13.6 (Impacts - Construction) and Section 13.7 (Impacts - Operation).

13.8.3 It should be noted that in addition to the measures proposed in this section, there has been significant environmental input to the design process to help inform the most sustainable design and drainage solution. This iterative approach has included discussion of proposed engineering options, their associated potential environmental impacts, and recommending measures that limit the impacts on the water environment. SEPA has also been consulted at various stages to review the proposals and agree aspects such as the number of treatment levels required; this is explained further in the following section.

Approach to Mitigation

13.8.4 Mitigation measures typically comprise solutions aimed at the source of the impact. The risk of causing deterioration in status of each water body can be reduced by aiming to 'design out' risks.

13.8.5 As stated in Section 13.3 (Methodology, Specific Methodologies), consultation with SEPA was undertaken prior to and during the EIA process to seek guidance on surface water drainage, pollution prevention measures and engineering activities on water bodies. Further information on the consultation process is provided in Chapter 6 (Consultation and Scoping).

Controlled Activities Regulations (CAR) 2011 (as amended)

13.8.6 Water features which require engineering work and construction activities would require a licence under the terms of CAR, as specified in Section 13.2 (Legislative and Policy Background). Works adjacent to water features may require a CAR licence, registration or compliance with GBRs. A CAR application would be made to SEPA for the higher risk activities which would include detailed information on the following:

- The proposed activity, its design and the reasons for the chosen design, as well as alternatives considered and reasons for rejection. The solution taken forward would be the best practicable environmental option, taking into account environmental, engineering, economic, and health and safety considerations.
- Details of the potential impacts to the water environment, including baseline environmental information and relevant environmental assessments.
- Details of the mitigation included in the design, aimed at reducing the potential impacts.
- A detailed construction methodology for all engineering activities.

13.8.7 Discussions on CAR authorisation and applications would be undertaken with SEPA and would continue during detailed design and mitigation refinement through the CAR application process.

Generic Construction Mitigation

13.8.8 An indicative construction programme, including typical construction activities, is provided in Chapter 4 (The Proposed Scheme), Section 4.8 (Construction Methods and Programme).

13.8.9 Prior to construction, the appointed contractor shall prepare a Construction Environmental Management Plan (CEMP), or equivalent, which shall address and mitigate risks identified in the

ES, and shall be approved by SEPA prior to construction. In addition, the Environmental Site Manager or a suitably qualified member of the construction team, e.g. Environmental Clerk of Works (EnvCoW), shall ensure that the mitigation measures identified within the CEMP are fully implemented and activities carried out in such a manner as to prevent or reduce impacts on the surface water environment (**Mitigation Item W1**).

13.8.10 Measures shall be taken by the appointed contractor to avoid, reduce or control pollution of surface water and groundwater and shall incorporate SEPA requirements and CIRIA guidelines for pollution control (CIRIA 1997, 2006a and 2006b), including relevant Pollution Prevention Guidelines (PPGs) (SEPA 2006, 2007, 2009b, 2011a, 2011b, 2011c, 2012 and 2013) (**Mitigation Item W2**).

13.8.11 To reduce potential increases in flows into the receiving watercourses during construction, the period of exposure of bare areas and uncontrolled runoff from newly paved areas shall be limited as far as practicable (**Mitigation Item W3**).

13.8.12 During temporary construction works, consideration shall be given to flood impacts. Plant and material shall be stored in safe areas above the 1:200-year flood event flood plain, where practicable, and the aim will be for temporary construction works to be resistant to flood impacts in order to prevent movement or damage during potential flooding events (**Mitigation Item W4**).

Working In-stream and Adjacent to Watercourses

13.8.13 The appointed contractor shall prepare construction method statements for any in-stream working for approval by SEPA prior to these specific works (**Mitigation Item W5**). The method statement shall include measures to:

- protect fish;
- deal with flowing water appropriately e.g. temporary diversions, over-pumping;
- reduce the risk of mobilisation of sediments to an acceptable level by employing reasonably practicable measures;
- protect banks where they are particularly vulnerable to erosion;
- undertake diversion of flow back into a channel in a manner that reduces the risk of erosion, with temporary bank stabilisation incorporated if necessary;
- avoid unnecessary in-stream working; and
- comply with SEPA's Good Practice Guide: Temporary Construction Methods (SEPA 2009a).

13.8.14 Where channel realignment is proposed the following principles shall be followed where possible (**Mitigation Item W6**):

- construct the new channel as early as possible prior to diverting flow from the existing channel to the new course to allow vegetation to colonise bank faces; and
- minimise the length of channel to be realigned.

Runoff from the Working Area

13.8.15 During construction of the roadway and associated works, the appointed contractor shall implement temporary drainage systems which will alleviate localised flood risk and help to prevent obstruction of surface runoff pathways (**Mitigation Item W7**). Temporary SUDS or equivalent to reduce the potential for contaminated runoff to watercourses shall be used. A number of these temporary SUDS shall, where appropriate, be incorporated into the operational drainage network when the road is completed, but additional site-specific SUDS may be required during construction and shall be removed once construction is complete. Care must be taken to avoid clogging and/or compaction of SUDS which are to be used during the operational phase.

Sedimentation and Earthworks

13.8.16 During the initial stage of construction, temporary SUDS or equivalent to reduce the potential for contaminated runoff to watercourses shall be implemented (**Mitigation Item W7**.

13.8.17 In addition, appropriate control measures for construction site runoff and sedimentation shall include(**Mitigation Item W8**):

- cleaning of roads to reduce mud and dust deposits (away from watercourses, into appropriate drainage sites);
- limit exposed bare areas and uncontrolled runoff from newly paved areas;
- covering and bunding, if required, of soil stockpiles;
- use of silt fences where appropriate;
- early covering/seeding/planting of exposed surfaces where practicable;
- where appropriate, provision of peripheral cut-off ditches or drainage system to intercept runoff from outside the working area such that it does not encroach on the working area;
- lay suitable surfacing materials in site compound and on main access routes; and
- regular proactive visual inspection of the sedimentation measures and receiving watercourses.

13.8.18 If flocculants are considered necessary to aid settlement of fine suspended solids, such as clay particles, the chemicals used must first be approved by SEPA (**Mitigation Item W9**).

13.8.19 Where required, CAR authorisation shall be obtained from SEPA and oil interceptor(s) shall be provided for vehicle parking areas, if required by SEPA (**Mitigation Item W10**).

13.8.20 The appointed contractor shall be required to comply with the relevant sections of BS6031:2009 Code of Practice for Earthworks (British Standards 2009) with respect to protection of water quality and control of site drainage including washings, dewatering, abstractions and surface water (**Mitigation Item W11**).

13.8.21 Where the appointed contractor considers the use of alternative materials to those assumed at the DMRB Stage 3 assessment stage for use as fill, e.g. in embankments, consultation with SEPA will be required prior to use of such material (**Mitigation Item W12**).

Watercourse Crossings

13.8.22 Advice and guiding principles from SEPA on new and extended watercourse crossings has been taken into consideration (consultation responses dated 11 January 2016 and 19 May 2016) (Appendix A6.2: Summary of Consultation). Opportunities to design to avoid the need for new or amended watercourse crossings were carefully considered in the first instance.

13.8.23 Where in-channel works are required for new and extended culverts, to reduce the potential for sediment release it is recommended that works are conducted during forecast low flow periods and the length of channel disturbed shall be minimised as far as practicable (**Mitigation Item W13**). Guidance on river crossings and culvert design contained in SEPA's Good Practice Guides (SEPA 2008 and 2009a) and CIRIA (2010) shall be followed. Measures to alleviate risks to the water environment associated with the construction of watercourse crossings shall be included in the appointed contractor's CEMP and approved by SEPA **(Mitigation Item GR1)**.

13.8.24 Requirements for grey (hard) bank scour protection (e.g. rock armour, rip-rap, gabion baskets) at culverts shall be limited to that absolutely required and options for use of alternatives such as none or green (soft) bank scour protection (e.g. vegetation, geotextile matting) shall be preferred. This is explained in more detail in Section 7 (Mitigation – Generic Operational Mitigation).

Outfalls

13.8.25 Effective mitigation for impacts associated with outfalls shall be based on the following principles (**Mitigation Item W14**), in accordance with SEPA's guidance for Intakes and Outfalls (SEPA 2008):

- Construction of outfalls shall not be conducted during periods of high flow, in order to reduce the risk of scour and erosion around the outfall structures or to the disturbed river bank.
- Limit the extent of channel/bank disturbance; consider the use of set-back outfalls first and use of swales rather than directly excavating into a watercourse.
- where practicable, provide sediment fences to prevent sediment wash into the watercourses;
- use of grey bank scour protection (e.g. rock armour, rip-rap, gabion baskets) at outfalls shall be limited to that absolutely required; and
- Each outfall shall be correctly positioned, informed by a geomorphologist or appropriately qualified person, to limit scour around the outfall. The outfall location and design shall be such that there would be no significant alteration to flow patterns, which may lead to turbulence and/or excessive deflection of flows towards the bed or banks of the channel. The outfall shall not project into the channel and shall not be located where flow converges with river banks causing higher shear stresses or where active bank erosion is occurring.

Oil and Fuels

13.8.26 Best practice measures associated with storage of oils and fuel shall be followed in compliance with The Water Environment (Oil Storage) (Scotland) Regulations 2006, SEPA PPG 2 (SEPA 2011a) and PPG 26 (SEPA 2011c), and shall be included within the appointed contractor's CEMP (**Mitigation Item W1 and GR1**).

Chemical Storage, Handling and Use

13.8.27 Effective mitigation for impacts associated with storage, handling and use of chemicals would be based on the following measures (**Mitigation Item W15**):

- Chemicals stored in drums would, as far as practicable, be stored within a secondary containment system. Containers without secondary containment shall not be placed within 10m of a watercourse or water body or within 50m of a spring, well or borehole.
- Chemical stores shall be located above the 0.5% AEP (1 in 200-year return period) flood level.
- Pesticides, including herbicides, should only be used if there are no alternative practicable measures, and shall be used in accordance with the manufacturer's instructions and application rates. Choice of pesticides should be those with least harm to the environment (i.e. least toxic and least persistent) suitable for the required purpose. Pesticide use near watercourses shall require prior approval of SEPA.

Controls for Use of Concrete, Cement and Grout

13.8.28 Concrete mixing and washing areas (**Mitigation Item W16**) shall:

- be located more than 10m from watercourses and water bodies;
- have settlement and re-circulation systems for water reuse;
- have a contained area for washing out and cleaning of concrete batching plant or ready mix lorries; and
- collect wash-waters and, where necessary, discharge to foul sewer (with the sewerage provider's permission) or contain wash-water for authorised disposal off-site.

13.8.29 Washwater from concrete and cement works shall not be discharged to the water environment. These waste waters shall be collected and, where necessary, discharged to the foul sewer (with the sewerage provider's permission) or off-site disposal authorisation sought (**Mitigation Item W17**).

Sewage Disposal

13.8.30 Sewage from site facilities shall be disposed of appropriately (**Mitigation Item W18**) either to:

- foul sewer with the permission of Scottish Water; or
- appropriate treatment and discharge agreed with Building Control and SEPA in advance of construction in accordance with PPG 04 (SEPA 2006) and CAR (SEPA 2011d).

Service Diversions and Excavation/Ground Penetration near Services

13.8.31 Service diversions, protection of utilities and local water supplies, excavations and ground penetration shall be carried out according to good practice (**Mitigation Item W19**). Potential services shall be identified using information from the service provider and through survey where necessary. Measures shall be taken to prevent damage to services and to avoid pollution during service diversions, excavation and ground penetration.

Management of Potentially Contaminated Land

13.8.32 Where works are proposed within areas of potentially contaminated land or where potentially contaminated groundwater is present, appropriate risk management measures shall be implemented to reduce the risk of pollution to an acceptably low level **(Mitigation Item W20)** (Chapter 11: Geology, Soils, Contaminated Land and Groundwater, Section 11.5: Mitigation, Table 12.21: Contaminated Land Mitigation).

Programme of Works

13.8.33 The potential impact of the proposed Scheme can be reduced through timely implementation of certain aspects of the construction works. A programme shall be developed to facilitate the practicable implementation of mitigation measures at the stage where their application would be most effective (**Mitigation Item W21**). In particular:

- SUDS shall be scheduled for construction early in the programme, as far as practicable, to allow settlement and treatment of any pollutants contained in site runoff and to control the rate of flow before water is discharged into a receiving watercourse. Additional temporary settlement ponds may also be required during construction, particularly in the vicinity of sensitive water bodies.
- In-channel works and works within the flood plain, i.e. construction activities or presence of personnel or construction plant within the 0.5% AEP (1 in 200-year return period) flood plain, shall be avoided during periods of high flow and increased flood risk, for health and safety reasons. In-channel works shall avoid spawning periods in salmonid watercourses. More detailed information on this can be found in Chapter 11 (Habitats and Biodiversity) along with work timings for particular species.

13.8.34 A detailed method statement for the layout and management of each part of the working area subject to a CAR licence shall be provided to SEPA for approval a minimum of four weeks, or by a date otherwise agreed with SEPA, prior to start of construction (**Mitigation Item W22**). The method statement shall identify, where appropriate, the location of drainage ditches, settlement ponds and sediment fences throughout the site to reduce the impact of turbid runoff whilst maintaining efficient operation of the site.

Monitoring and Inspection during Construction

13.8.35 The appointed contractor shall be required to monitor water quality prior to and during construction, assessing chemical and biological parameters as required by SEPA. Parameters, duration, frequency and limits of sampling shall be agreed with SEPA in advance of construction (**Mitigation Item W23**). SEPA requirements for monitoring shall be determined during the CAR licence application process and agreed monitoring shall be embedded within the CEMP (**Mitigation Item W1 and GR1**).

13.8.36 Regular inspections shall be carried out by the EnvCoW to identify and recommend appropriate actions for aspects such as unacceptably high pollution risk, or any suspected incidences of pollution (**Mitigation Item W24**). Where necessary, a Pollution Incident Response Plan shall be prepared and implemented, in line with SEPA PPG 21 (SEPA 2009b) and PPG 22 (SEPA 2011b). This shall include formulation of emergency procedures to address accidental pollutant releases and spillages, and shall include appropriate staff briefings, toolbox talks and other staff training, as required (**Mitigation Item W25**).

Table 13.18: Summary of Generic Mitigation Measures during Construction

Source of Impact	Mitigation
Flood Risk	To reduce potential increases in runoff into the receiving watercourses during construction, the period of exposure of bare areas and uncontrolled runoff from newly paved areas shall be limited as far as practicable **(Mitigation Item W3)**. During temporary construction works, plant and material shall be stored in safe areas outside the flood risk area where practicable, and the aim will be for temporary construction works to be resistant to flood impacts to prevent movement or damage during potential flooding events **(Mitigation Item W4)**. During construction of a new roadway and associated works, temporary drainage systems shall alleviate localised flood risk and prevent obstruction of surface runoff pathways **(Mitigation Item W7)**.
In-channel works in watercourses	Preparation of construction method statements for approval by SEPA **(Mitigation Item W5)**. Compliance with PPGs including PPG 1 (SEPA 2013), PPG 5 (SEPA 2007), PPG 6 (SEPA 2012) and SEPA Good Practice Guides (SEPA 2008 and 2009a) **(Mitigation Items W2 and GR1)**. Compliance with CAR 2011 (as amended) authorisation requirements **(Mitigation Items W10 and GR1)**.
Runoff from working area	Temporary drainage systems to alleviate localised flood risk; temporary (and permanent) SUDS (or equivalent) to reduce potential for contaminated runoff to water bodies **(Mitigation Item W7)**. Adherence to CIRIA C648 (CIRIA 2006a) and C697 (CIRIA 2007a) **(Mitigation Item W2)**. Other runoff and erosion control measures to include as appropriate: provision of wheel washes more than 10m from watercourses and appropriate disposal of dirty water; cleaning of roads; limit exposed bare areas; covering of stockpiles; use of silt fences; provision of peripheral cut-off ditches to intercept runoff from entering working area; regular inspection and monitoring of receiving watercourses **(Mitigation Items W15 and W16)**. Any flocculants to be approved in advance by SEPA **(Mitigation Item W9)**. Temporary discharge consents to be obtained from SEPA, where required **(Mitigation Item W18)**. Compliance with relevant sections of BS6031:2009 (British Standards 2009) **(Mitigation Item W11)**.
Watercourse crossings	Works to be conducted in low flow conditions **(Mitigation Item W13)**. Compliance with CAR 2011 (as amended) authorisation requirements and SEPA Good Practice Guides (SEPA 2008 and 2009a) **(Mitigation Items W2, W10 and GR1)**. Grey bank scour protection, at culverts limited to that absolutely required and consideration given to alternative options, e.g. none or green bank protection **(Mitigation Items W13 and W14)**.
Outfall construction	Construction shall not be conducted during periods of high flow **(Mitigation Item W13)**. Sediment fences shall be used as far as practicable to prevent sediment being washed into watercourse **(Mitigation Item W14)**. Limit extent of channel/bank disturbance and compliance with SEPA Good Practice Guides (SEPA 2008 and 2009a) **(Mitigation Items W2 and GR1)**. Compliance with CAR 2011 (as amended) authorisation requirements **(Mitigation Item W10)**. Grey bank scour protection at outfalls, limited to that absolutely required and consideration given to alternative options, e.g. none or green bank protection **(Mitigation Items W13 and W14)**.
Refuelling	Compliance with the Water Environment (Oil Storage) (Scotland) Regulations 2006 **(Mitigation Item GR1)**. Compliance with PPG 2 (SEPA 2011a) **(Mitigation Item W25)**. Bunded areas of sufficient storage capacity (at least 110% of maximum tank capacity) with impervious walls and floor lining for the storage of fuel, oil and chemicals **(Mitigation Item W15)**. Appropriate measures, including site security, to avoid spillages **(Mitigation Items W15 and GR1)**. Compliance with the Pollution Incident Control Plan and SEPA PPG 21 (SEPA 2009b) and PPG 22 (SEPA 2011b) **(Mitigation Item W25)**.
Oil/fuel leaks and spillages	Stationary plant shall be fitted with drip trays and emptied regularly; plant machinery to be properly maintained **(Mitigation Items W25 and GR1)**. Spillage kits shall be stored at key locations on-site **(Mitigation Items W25 and GR1)**. Compliance with the Pollution Incident Control Plan and SEPA PPG 21 (SEPA 2009b) and PPG 22 (SEPA 2011b) **(Mitigation Item W25)**.

Source of Impact	Mitigation
Chemical storage, handling and use	Compliance with PPG 26 (SEPA 2011c) **(Mitigation Item GR1)**. Appropriate storage and containment of chemicals; stores to be located above the 0.5% AEP (1 in 200-year return period) flood level where practicable **(Mitigation Items W15 and GR1)**.
Concrete, cement and grout	Concrete mixing and washing areas shall be located more than 10m from water bodies **(Mitigation Item W16)**. Wash water shall not be discharged to the water environment and shall be disposed of appropriately **(Mitigation Item W17)**.
Sewage disposal	Compliance with PPG 4 (SEPA 2006) **(Mitigation Item WGR1)**. Sewage to be disposed of appropriately in compliance with SEPA and CAR **(Mitigation Items W2, W10 and GR1)**.
Service diversions and excavation/ ground penetration	Adherence to best practice **(Mitigation Item W19)**.
Contaminated land and sediment	In areas where ground contains elevated concentrations of contaminants, appropriate measures shall be implemented to reduce risk of surface water pollution to an acceptably low level **(Mitigation Item W20)**.

Generic Operational Mitigation

Drainage

13.8.37 The drainage system of the proposed Scheme has been designed in accordance with the following guidance:

- Control of Pollution from Highway Drainage Discharges (CIRIA 1997);
- Sustainable Drainage Systems, CIRIA C609 (CIRIA 2004);
- The SUDS Manual, CIRIA C753 (CIRIA 2015);
- Site handbook for the construction of SUDS, CIRIA C698 (CIRIA 2007b);
- SUDS for Roads (Scottish Water 2010);
- DMRB HA103/06; and
- DMRB Volume 4, Section 2, Part 9, HA119/06 Grassed Surface Water Channels for Highway Runoff (Highways Agency, Transport Scotland, Welsh Assembly Government and The Department for Regional Development Northern Ireland 2006b).

13.8.38 Where it has been identified as necessary for road drainage to discharge to SWFs, mitigation shall be designed to limit the volume of discharge and the risk to water quality. Where required, authorisation for the road drainage discharge under CAR 2011 (as amended) shall be obtained from SEPA (**Mitigation Item W26**).

13.8.39 Through consultation, SEPA has requested the provision of three levels of treatment for outfalls into the River Nairn and its tributaries and a minimum of two levels of treatment for outfalls into all other SWFs. This level of treatment is for the dual carriageway alignment of the proposed Scheme only; one level of treatment shall be required for outfalls into SWFs from the majority of the local roads. For each outfall, a 'treatment train' of SUDS measures shall be incorporated to attenuate the road runoff to pre-development rates, reduce the polluting load carried within this runoff to acceptable levels and significantly reduce the risk of any accidental spillages **(Mitigation Item GR3)**.

13.8.40 All of the proposed SUDS for the outfalls from the proposed Scheme (dual carriageway alignment) shall be designed with an impermeable liner to reduce any identified risk of pollution to groundwater, unless otherwise agreed with SEPA by the appointed contractor. The proposed SUDS for some selected local road drainage networks shall infiltrate into the ground. This chapter is primarily concerned with surface water. The assessment of groundwater is covered in Chapter 11: Geology, Soils, Contaminated Land and Groundwater.

13.8.41 SUDS basins shall be sized to attenuate and store the 1% AEP (1 in 100 year return period) + 20% climate change flood event and restrict the outflow to the greenfield pre-development runoff rate of

50% AEP (1 in 2 year return period) flood event. SUDS shall be located outwith the functional (0.5% AEP) flood plain (**Mitigation Item W27**).

13.8.42 The hydraulic and water quality performance potential of each SUDS technique has informed the drainage design based on their primary functions and capabilities. SUDS have been selected to include different stages of the 'treatment train' (pre-treatment, conveyance, source, site or regional controls). The primary functions and the water quality treatment processes for each SUDS technique included within the proposed Scheme design is listed in Table 13.19.

Table 13.19: Primary Functions and Capabilities of Proposed Scheme SUDS

SUDS Treatment System	Component	Primary Functions and Capabilities
Filter Drains	Management Train Suitability	Conveyance, Source Control
	Water Quantity	Conveyance, Detention
	Water Quality	Filtration, Adsorption, Biodegradation, Volatilisation
Swales	Management Train Suitability	Conveyance, Source control, Site control
	Water Quantity	Conveyance, Detention
	Water Quality	Sedimentation, Filtration, Adsorption, Biodegradation
SUDS retention ponds	Management Train Suitability	Site Control, Regional Control
	Water Quantity	Detention, Water harvesting
	Water Quality	Sedimentation, Filtration, Adsorption, Biodegradation, Volatilisation, Precipitation, Uptake by plants, Nitrification

Source: Table 1.7. CIRIA (2007a)

Outfall Structures

13.8.43 Each outfall shall be positioned to limit scour potential around the culvert. The outfall location and design shall be such that there will be no significant alteration to flow patterns which may lead to turbulence and/or excessive deflection of flow towards the bed or banks of the channel. The outfall shall not project into the channel and shall not be located where flow converges with river banks causing higher shear stresses or where active bank erosion is occurring (**Mitigation Item W28**). Design and construction of outfall structures shall comply with best practice in CIRIA (2016) and DMRB Volume 4, Section 2, Part 7, HA107/04 Design of Outfall and Culvert Details (Highways Agency, Scottish Executive, Welsh Assembly Government and The Department for Regional Development Northern Ireland 2004) (hereafter DMRB HA107/04) and take cognisance of SEPA's Good Practice Guide: Intakes and Outfalls (SEPA 2008) (**Mitigation Item W29**).

New and Extended Culverts

13.8.44 Where existing culverts require extension the existing hydraulic capacity will not be reduced, in line with SEPA guidance. The extensions may lead to building within the existing flood plain. Mitigation for infill within the flood plain may be provided through compensatory storage, if necessary. New culverts shall be designed in accordance with guidance contained in CIRIA C689 and DMRB HA 107/04 (see below) **(Mitigation Item W30)**.

13.8.45 Culvert extensions shall match the form of existing structures, unless this conflicts with commitment W29, to ensure that there is no change in form (widening, narrowing and separation), which could interrupt sediment transport. If a change in form is required, the design shall incorporate the preservation of sediment transport and allow the formation of a natural bed through the structure **(Mitigation Item W31)**.

Channel Realignments

13.8.46 The detailed design of channel realignment shall include the input from a range of appropriate specialists (e.g. engineers, ecologists and geomorphologists), as well as SEPA representatives where appropriate, to incorporate mitigation measures and consider any feasible improvement of the watercourse morphology and habitats **(Mitigation Item W32)**.

13.8.47 Where channel realignment is proposed the following principles shall be followed where practicable (**Mitigation Item W33**):

- minimise length of required realignment;
- maintain gradient of watercourse; and
- increase sinuosity of channel, create low flow two-stage channel to narrow channel and reduce siltation potential.

Compensatory Storage

13.8.48 Where the proposed Scheme may affect the functional flood plain, potential to incorporate mitigation measures including the provision of compensatory storage has been investigated as part of the design process. The approach adopted and summarised in the following paragraphs below has been agreed with SEPA. Refer to Appendix A13.2 (Flood Risk Assessment) for details of calculations and assessment.

13.8.49 Compensatory storage shall be designed to achieve a neutral flood impact, providing the same response as the current floodplain **(Mitigation Item W34)**.

Specific Operational Mitigation

13.8.50 SWF specific mitigation during the operation of the proposed Scheme is described in the following text.

Hydrology and Flood Risk

13.8.51 The following specific mitigation measures have been proposed for watercourses which have the potential to be adversely impacted by the proposed Scheme. Where the potential flood risk mechanisms were deemed complex enough to require the development of hydraulic models the mitigation measures have been included in model simulations to demonstrate their effectiveness. For further details refer to Appendix 13.2 Flood Risk Assessment Where mitigation is required for simple situations an examination of constraints that may preclude its successful development has been undertaken.

Table 13.20: Proposed Mitigation for Impacted Surface Water Features

Watercourse	Proposed Mitigation	Impact
SWF 03	SWF03 and SWF06 are hydraulically linked and the proposed solution provides mitigation to both watercourses. This comprises: Provision of a flood bypass channel in SWF06 to prevent flooding of land that would be occupied by the proposed Scheme Increasing the online storage capacity of the realigned section of the Cairnlaw Burn. Provide a control on flows at proposed culvert C04 to regulate use of the newly created storage..	Management of flood flows within the study area and at the location of flood sensitive receptors. With mitigation the flood risk would be unchanged against the baseline case.
SWF 06		
SWF09	Provision of compensatory flood storage near culvert SWF09-A to extend the current flood plain area. This is to mitigate the loss of floodplain area to the proposed Scheme.	This will provide the same response as the current floodplain to design flood events.
SWF 12	Two flood relief culverts are proposed to allow connectivity of existing overland flood flow routes through the proposed Scheme (as per baseline).	Impacts closer to the baseline scenario with mitigation but with limited areas of increased water levels. No sensitive receptors are simulated to be affected.
SWF 16	Provision of a flood storage area upstream of the C14 culvert, requiring an engineered earth bund. This would fall under the jurisdiction of the Reservoirs Act (Scotland) 2011	Manage flood risk through this section of the proposed Scheme.
SWF 26	Channel widening upstream of culvert C21 with two stage channel design.	Reduce water backing up at culvert.

Water Quality

13.8.52 The drainage strategy for the proposed Scheme includes two types of treatment train – each outfall shall use one or the other. Treatment Train 1 shall comprise two levels of treatment (filter drains and a SUDS retention pond); Treatment Train 2 shall comprise three levels of treatment (filter drains, a SUDS retention pond and a swale) **(Mitigation Item GR3)**. Treatment Train 2 shall be for outfalls into the River Nairn and its tributaries, as requested by SEPA, and for Outfall O, because HAWRAT indicates that a higher level of treatment than Treatment Train 1 is required for this outfall (when both Tier 1 and Tier 2 information is included at Step 2) (Table 13.22).

13.8.53 As explained above, each mainline catchment is linked to a SUDS retention pond. Where multiple SUDS are shown on the drawings B2103500-HW-0100-SK-137 and B2103500-HW-0100-SK-138 Chapter 4 (Engineering Assessment) of the DMRB Stage 3 Scheme Assessment Report, the upstream (first) element will be the SUDS retention pond (wet pond), which then links into SUDS detention basin (dry pond).

13.8.54 Table 13.21 lists the proposed mitigation for each SWF that shall receive routine runoff from the dual carriageway alignment.

Table 13.21: Proposed SUDS for the Proposed Scheme by Outfall

Drainage Catchments/Outfall	Receiving Watercourse	Proposed SUDS Treatment Train
A	SWF 02	Treatment Train 1
B	SWF 02	Treatment Train 1
C	SWF 02	Treatment Train 1
D	SWF 03	Treatment Train 1
E	SWF 03	Treatment Train 1
F	SWF 06	Treatment Train 1
G	SWF 08	Treatment Train 1
H	SWF 09	Treatment Train 1
I	SWF 09	Treatment Train 1
J	SWF 13	Treatment Train 1
K	SWF 13	Treatment Train 1
L	SWF 16	Treatment Train 1
M	SWF 16	Treatment Train 1
N	SWF 18	Treatment Train 1
O	SWF 19	Treatment Train 2
P	SWF 19	Treatment Train 1
Q	SWF 19	Treatment Train 1
R	SWF 22	Treatment Train 1
S	SWF 23	Treatment Train 2
T	SWF 24	Treatment Train 2
U	SWF 24	Treatment Train 2
V	SWF 16	Treatment Train 2
W	SWF 26	Treatment Train 2
X	SWF 26	Treatment Train 2
Y	SWF 26	Treatment Train 2
Z	SWF 35	Treatment Train 2

13.8.55 The calculated treatment efficiencies of each proposed treatment train are provided in Appendix A13.3 (Water Quality Calculations). These calculations have been used in the Step 3 routine runoff assessment.

13.9 Residual Impacts

13.9.1 Following implementation of the mitigation outlined in Section 13.8 (Mitigation), the potential for impacts on the water environment would be avoided/prevented, reduced or offset.

13.9.2 Residual impacts during both the construction and operational phases are summarised for each attribute of the water body in Appendix A13.4 (Residual Impact Tables (Road Drainage and the Water Environment)). The vast majority of residual impacts would be reduced to Neutral significance, due to the adoption of appropriate mitigation measures. The remaining residual impacts that would not be of Neutral significance are described below.

Construction Impacts

Hydrology and Flood Risk

13.9.3 Provided mitigation mentioned in Section 13.8 (Mitigation) is adhered to, it is anticipated that there would be no residual impacts of Slight significance or higher in the construction phases on all SWFs. A particular focus will be needed on Mitigation items W4 and W7 to achieve this.

Fluvial Geomorphology

13.9.4 Provided mitigation mentioned in Section 13.8 (Mitigation) is adhered to, it is anticipated that there would be no residual impacts of Slight significance or higher in the construction phases on all SWFs.

Water Quality

13.9.5 The majority of impacts arising from the construction of the proposed Scheme would be 'Neutral' (i.e. neither significantly adverse nor significantly beneficial). However, the following adverse residual impacts have been identified, the majority of which are not significant:

- Impacts on the attribute 'water quality/supply' have the potential to be of Slight adverse significance on the following SWFs as a result of in-channel works: SWF 02, SWF 03, SWF 05, SWF 06, SWF 07, SWF 08, SWF 09, SWF 12, SWF 13, SWF 14, SWF 15, SWF 16, SWF 17, SWF 18, SWF 19, SWF 21, SWF 22, SWF 24, SWF 26 and SWF 35.
- Impacts on the attribute 'biodiversity' have the potential to be of Slight adverse significance on the following SWFs as a result of in-channel works: SWF 02, SWF 05, SWF 06, SWF 07, SWF 08, SWF 09, SWF 12, SWF 13, SWF 14, SWF 15, SWF 16, SWF 17, SWF 18, SWF 21, SWF 22 and SWF 35.
- Impacts on the attribute 'biodiversity' have the potential to be of Moderate adverse significance on SWF 03, SWF 24 and SWF 26 as a result of in-channel works. The significance for all three SWFs is due in part to the importance of this attribute (very high importance because Protected Area for Freshwater Fish or presence of internationally important fish species).

13.9.6 These construction impacts would all be short-term in nature and would not continue beyond the construction phase.

Operational Impacts

Hydrology and Flood Risk

Providing mitigation identified in Section 13.8 (Mitigation) is adhered to it is anticipated that there would be no residual impacts of Slight significance or higher.

Fluvial Geomorphology

13.9.7 Provided mitigation mentioned in Section 13.8 (Mitigation) is adhered to, it is anticipated that there would be no residual impacts of Moderate significance or higher on the majority of SWFs during operation.

13.9.8 A Slight significance residual impact has been identified on four SWFs: SWF 02, SWF 03, SWF 12 and SWF 26. This is due to the replacement of natural bank and bed with artificial material which would result in a permanent impact from the dynamic function of the existing channel within these

SWFs. It is anticipated, however, that these impacts would be local and would not have an impact at the catchment scale.

Water Quality

HAWRAT Step 3 Routine Runoff Assessment Results (with Mitigation)

13.9.9 A Step 3 HAWRAT routine runoff assessment has been completed for those outfalls that failed the Step 2 assessment for soluble acute and/or sediment chronic impacts. The Step 3 assessment considers the residual impacts following mitigation. The detailed results of the assessment can be found in Appendix A13.3 (Water Quality Calculations).

13.9.10 Table 13.22 summarises the results of the Step 3 individual HAWRAT routine runoff assessment for soluble and sediment-bound pollutants.

13.9.11 Table 13.23 summarises the results of the Step 3 cumulative routine runoff assessment for soluble and sediment-bound pollutants.

13.9.12 Table 13.24 summarises the results of the Step 3 cumulative routine runoff assessment for soluble impacts.

Table 13.22: Summary of Step 3 HAWRAT Individual Routine Runoff Assessment (Do Something)

Drainage Catchment/Outfall	Step 2 Assessment Tier	Treatment Train	Receiving Watercourse	HAWRAT Results		Compliance with Environmental Quality Standards
				Soluble Acute Impacts	Sediment Chronic Impacts	
F	Tier 1	Treatment Train 1	SWF 06	Pass	Alert 3	Pass
G	Tier 1	Treatment Train 1	SWF 08	Pass	Alert 2	Pass
H	Tier 1	Treatment Train 1	SWF 09	Pass	Alert 2	Pass
I	Tier 1	Treatment Train 1	SWF 09	Pass	Alert 2	Pass
J	Tier 1	Treatment Train 1	SWF 13	Pass	Pass	Pass
K	Tier 1	Treatment Train 1	SWF 13	Pass	Pass	Pass
N	Tier 1	Treatment Train 1	SWF 18	Pass	Pass	Pass
O	Tier 1	Treatment Train 1	SWF 19	**Fail**	**Fail**	**Fail**
	Tier 2	Treatment Train 1		**Fail**	**Fail**	**Fail**
	Tier 2	Treatment Train 2		Pass	Pass	Pass
Q	Tier 1	Treatment Train 1	SWF 19	Pass	Alert 2	Pass
T	Tier 1	Treatment Train 2	SWF 24	Pass	Alert 1	Pass
U	Tier 1	Treatment Train 2	SWF 24	Pass	Alert 1	Pass
Z	Tier 1	Treatment Train 2	SWF 35	Pass	Pass	Pass

Table 13.23: Summary of Step 3 HAWRAT Cumulative Routine Runoff Assessment for Soluble and Sediment Impacts (Do Something)

Drainage Catchment/Outfall	Step 2 Assessment Tier	Treatment Train	Receiving Watercourse	HAWRAT Results		Compliance with Environmental Quality Standards
				Soluble Acute Impacts	Sediment Chronic Impacts	
B & C	Tier 1	Treatment Train 1	SWF 02	Pass	Alert 3	Pass
D & E	Tier 1	Treatment Train 1	SWF 03	Pass	Alert 3	Pass
H & I	Tier 1	Treatment Train 1	SWF 09	Pass	**Fail**	Pass
	Tier 2	Treatment Train 1		Pass	Alert 2	Pass
L, V & M	Tier 1	Treatment Train 1	SWF 16	Pass	Alert 2	Pass
P & Q	Tier 1	Treatment Train 1	SWF 19	Pass	**Fail**	Pass
	Tier 2	Treatment Train 1		Pass	Alert 2	Pass
T & U	Tier 1	Treatment Train 2	SWF 24	Pass	Alert 1	Pass

Table 13.24: Summary of Step 3 HAWRAT Cumulative Routine Runoff Assessment for Soluble Impacts (Do Something)

Drainage Catchment/Outfall	Step 2 Assessment Tier	Treatment Train	Receiving Watercourse	HAWRAT Results Soluble Acute Impacts	Compliance with Environmental Quality Standards
A, B & C	Tier 1	Treatment Train 1	SWF 02	Pass	Pass
J & K	Tier 1	Treatment Train 1	SWF 13	Pass	Pass

13.9.13 The HAWRAT Step 3 assessments have concluded that all of the proposed outfalls pass the routine runoff assessment for soluble and sediment-bound pollutants and the assessment against EQSs. With the exception of Outfall O, all outfalls pass the assessment with the minimum level of SUDS treatment required by SEPA (three levels for outfalls into the River Nairn and its tributaries; two levels for all other watercourses). Outfall O required three levels of treatment to pass all aspects of the assessment (Treatment Train 2). This level of treatment has been included in the drainage design for this outfall.

13.9.14 The majority of impacts arising from the operation of the proposed Scheme would be 'Neutral' (i.e. neither significantly adverse nor significantly beneficial). However, the following beneficial impacts have been identified:

- SWF 09: the residual operational impacts on the attributes 'water quality/supply' and 'biodiversity' have the potential to be of Slight beneficial significance. This is largely because the existing outfall (assumed) into SWF 09 (Outfall 6) failed the individual routine runoff assessment for soluble acute impacts, whereas the proposed outfalls into this SWF (outfalls H and I) passed the individual and cumulative Step 3 HAWRAT routine runoff assessments (albeit with an Alert 2 for sediment-bound pollutants).
- SWF 13: the residual operational impacts on the attributes 'water quality/supply' and 'biodiversity' have the potential to be of Slight beneficial significance. This is largely because the existing outfall (assumed) into SWF 13 (Outfall 9) failed the individual routine runoff assessment for soluble acute impacts, whereas the proposed outfalls into this SWF (outfalls J and K) passed the individual and cumulative Step 3 HAWRAT routine runoff assessments.
- SWF 18: the residual operational impacts on the attributes 'water quality/supply' and 'biodiversity' have the potential to be of Slight beneficial significance. This is largely because the existing outfall (assumed) into SWF 18 (Outfall 13) failed the Step 3 individual routine runoff assessment for soluble acute and sediment chronic impacts.

Summary of Residual Impacts

Hydrology and Flood Risk

13.9.15 Provided mitigation mentioned in Section 13.8 (Mitigation) is adhered to, it is anticipated that there would be no residual impacts of Slight significance or higher in the construction phases on all SWFs. A particular focus will be needed on Mitigation items W4 and W7 to achieve this.

13.9.16 The majority of impacts arising from the proposed Scheme during operation would be of Neutral significance if the identified mitigation is implemented. The mitigation at SWF 03, SWF 06 and SWF 16 is complex and requires further detailed design, but the modelling undertaken in support of the Flood Risk Assessment demonstrates that it can provide appropriate management of flood risk.

Fluvial Geomorphology

13.9.17 Provided mitigation mentioned in Section 13.8 (Mitigation) is adhered to, it is anticipated that there would be no residual impacts of Slight significance or higher during the construction phase.

13.9.18 During the operation phase, it is anticipated that there would be no residual impacts of Moderate significance or higher on the majority of SWFs provided mitigation mentioned in Section 13.8 (Mitigation) is adhered to

13.9.19 A Slight significance residual impact has been identified on four SWFs during the operational phase: SWF 02, SWF 03, SWF 12 and SWF 26. This is due to the replacement of natural bank and bed with artificial material which would result in a permanent impact from the dynamic function of the existing channel within these SWFs. It is anticipated, however that these impacts would be local and would not have an impact at the catchment scale.

Water Quality

13.9.20 The majority of impacts arising from the construction of the proposed Scheme would be 'Neutral' (i.e. neither significantly adverse nor significantly beneficial). However, a number of adverse residual impacts have been identified (the majority of which would not be significant). These impacts would largely be the result of a pollution incident during the in-channel works and are reflective of the level of risk with mitigation in place. Most of the adverse impacts that have been identified are of Slight adverse significance and are therefore not considered to be significant. However, impacts on the attribute 'biodiversity' have the potential to be of Moderate adverse significance for SWFs 03, 24 and 26. The significance for all three SWFs is due in part to the importance of this attribute (very high importance because Protected Area for Freshwater Fish or presence of internationally important fish species).

13.9.21 All of the potential operational impacts would be of Neutral or Slight beneficial significance. No adverse operational impacts have been identified.

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