11 Road Drainage and the Water Environment

11.1 Introduction

11.1.1 This chapter presents the Environmental Impact Assessment (EIA) of potential impacts associated with the '*Design Manual for Roads and Bridges*' (DMRB) Stage 3 Proposed Scheme on the natural water environment for Project 7 – Glen Garry to Dalwhinnie (Central Section) of the A9 Dualling Programme. The Proposed Scheme alignment to be assessed is described in **Chapter 5**.

11.1.2 This chapter presents the EIA approach, describing baseline conditions, design development and embedded mitigation. In identifying key issues for assessment and potential impacts, mitigation to reduce or negate any potential impacts is proposed and any remaining 'residual' impacts are identified.

11.1.3 The information and findings of this chapter will also support future Controlled Activity Regulations (CAR) applications and provide input to Habitats Regulations Appraisal (HRA).

11.1.4 The approach described follows guidance set out in DMRB (2009), Volume 11: Environmental Assessment, Section 3, Part 10, HD45/09: '*Road Drainage and the Water Environment*' (DMRB HD45/09). The assessment has a particular requirement to assess significant environmental impacts of the project as defined in DMRB (1993), Volume 5, Section 1, Part 2 TD37/93: '*Scheme Assessment Reporting*' (DMRB TD 37/93). This involves a 'detailed' assessment of the potential environmental impacts, with consideration given to the following attributes of the water environment:

- Importance of the surface water and groundwater environment
- Proposed Scheme construction and operation related pollution
- Hydrology and flood risk
- Changes to hydromorphology
- Surface water quality and quantity
- Groundwater quality

11.1.5 In the context of this chapter 'surface water' means all standing or flowing water on the surface of the land (e.g. rivers, lochs, canals, reservoirs, ponds and wetlands). 'Wetland' means an area of ground, the ecological, chemical and hydrological characteristics of which are attributable to frequent inundation or saturation by water and which is directly dependent, with regard to its water needs, on a body of groundwater or a body of surface water.

11.1.6 The water environment is intrinsically linked to ecological receptors. Where relevant, references to **Chapter 12** have been made in this chapter and related appendices. Similarly, this chapter considers potential impacts to groundwater quality (associated with road runoff and spillage). Potential impacts to groundwater resulting from disturbances to groundwater flow including potential interference with Private Water Supplies (PWS) are discussed and assessed in **Chapter 10**.

11.1.7 Supporting assessments also relating to the water environment e.g. land use (waterway restoration projects, loss of watering points for livestock) and landscape considerations (sensitive naturalistic design of watercourses) are provided in **Chapter 8** and **Chapter 13**, respectively.

11.2 Approach and Methods

11.2.1 This section describes the procedures used to assess potential impacts of the Proposed Scheme on the natural water environment, categorised under the following headings: Surface and Groundwater Quality, Hydrology and Flood Risk and Hydromorphology.

11.2.2 Sources of relevant guidance, the study area, baseline data sources, and procedures for assigning qualitative and quantitative values for the potentially affected water features are described in this section. Limitations of the assessments are also discussed. More detailed methodological information for each of the supporting assessments is provided in separate appendices.

Legislative Context

11.2.3 The assessment has taken into account relevant legislation and regulations including:

- Water Framework Directive (WFD) (2000/60/EC)
- Water Environment Water Services (WEWS) Act 2003
- The Water Environment (Controlled activities) (Scotland) Regulations 2011 (as amended) (CAR)
- EU Floods Directive (2007/60/EC)
- Flood Risk Management (Scotland) Act 2009
- The Climate Change (Scotland) Act 2009
- Water Framework Directive (WFD) policy guidance 'The Future for Scotland's Waters, Guiding Principles on the Technical Requirements of the Water Framework Directive' (SEPA, 2002)
- European Union (EU) Drinking Water Directive (98/83/EC)
- The Environment Act 1995
- Surface Waters (Fishlife) (Classification) (Scotland) (Amendment) Regulations, 2003
- Control of Pollution Act 1974 (CoPA)
- Environmental Protection Act 1990
- Environmental Liability (Scotland) Regulations 2009
- The Water Supply (Water Quality) (Scotland) Regulations, 2001
- The Public Water Supplies (Scotland) Regulations 2014
- The Private Water Supplies (Scotland) Regulations 2006
- The Water Environment (Oil Storage) (Scotland) Regulations 2006
- Pollution Prevention and Control (Scotland) Regulations 2012 (PPC 2012)

11.2.4 Further detail regarding compliance with national/ local planning policies associated with the water environment is provided in **Chapter 19**.

Scope and guidance

11.2.5 In addition to the guidance in DMRB HD45/09, various other reference documents have been used in the assessment. A list of the principal reference documents is provided under the following headings:

Pollution prevention and flood risk/ mitigation measures, pertinent to surface water and groundwater

- DMRB, 2006, Volume 4: Geotechnics and Drainage, Section 2: Drainage, Part 1, HA103/06: '*Vegetated Drainage Systems for Highway Runoff*', and Part 3, HD33/06: '*Surface and Sub-surface Drainage systems for Highways*'
- '*Sustainable Drainage Systems, Hydraulic, Structural and Water Quality Advice*', CIRIA C609, 2004
- '*The Sustainable Drainage Systems (SuDS) Manual*', Construction Industry Research and Information Association (CIRIA) C753, 2015 and SuDS for Roads, WSP, 2009
- '*Scottish Planning Policy*', 2014 and '*Planning Advice Note 61: Planning & SuDS*'
- '*Control of Pollution from Highway Drainage Discharges'*, CIRIA C142, 1994
- 'Regulatory Method (WAT-RM-08), *'Sustainable Urban Drainage Systems (SUDS or SUD Systems)*', SEPA, v6.1, 2017 and Supporting Guidance (WAT-SG-53) *'Environmental Standards for Discharges to Surface Waters*' v6, SEPA, 2015
- '*User Guide: Groundwater Vulnerability (Scotland) Geographical Information System (GIS) Dataset*', Version 2 (OR/15/002), British Geological Survey, 2015
- '*Groundwater Protection Policy for Scotland Version 3, Environmental Policy Number 19*', SEPA, 2009
- '*Technical Flood Risk Guidance for Stakeholders*', SEPA, 2015

Watercourse diversion and culvert designs

- DMRB, 2004, Volume 4: Geotechnics and Drainage, Section 2: Drainage, Part 7, HA107/04: '*Design of Outfall and Culvert Details*'
- '*Manual of River Restoration Techniques'*, RRC, 2002
- '*River Diversions A Design Guide*', HR Wallingford, 2001
- '*Culvert Design and Operation Guide*', CIRIA C689, 2010
- '*Engineering in the Water Environment: Good Practice Guide, River Crossings'* Second Edition (WAT-SG-25), SEPA 2010
- '*River Crossings and Migratory Fish*', Design Guidance, Scottish Executive

Construction phase activities

- WAT-SG-29: '*Temporary Construction Methods*', Good Practice Guide, SEPA, 2009
- WAT-SG-31: '*Special Requirements for Civil Engineering Contracts for the Prevention of Pollution*', SEPA, 2006 and WAT-SG-32: '*Guidance on the Special Requirements for Civil Engineering Contracts*', SEPA, 2006
- '*Control of Water Pollution from Linear Construction Projects*', Technical Guidance (C648), 2006

Study area

11.2.6 The Proposed Scheme assessed in this report runs parallel to the east of the River Garry, Allt Dubhaig and the River Truim. The Proposed Scheme is approximately 10km in length beginning just south of Dalnaspidal at approx. chainage (ch.) -950, travelling northwards to end carriageway tie-in works at approx. ch. 9,750 (extending out to approx. ch. 10,180 including the Beauly to Denny power line (BDL) access track connections).

11.2.7 A 1km-wide corridor, notionally 500m to the east and west of the existing A9, was initially defined as the study area for assessment of potential Road Drainage and Water Environment impacts. The River Garry, the River Allt Dubhaig and the River Truim act as hydrological barriers and it is unlikely that the Proposed Scheme will have an impact on water features beyond the opposite banks from the A9. Therefore, the study for this assessment has been refined and is now defined by:

- Hydrological features shown on a 1:10,000 Ordnance Survey (OS) map, and identified in more detail on the Blom topographical survey, have been delineated by a 500m offset upstream of the existing A9 corridor and the left bank (looking downstream) of the River Truim/ right bank (looking downstream) of the River Garry. The nominal distance has been extended in cases where there are significant hydrological features that may potentially be affected by the Proposed Scheme. This has been defined as the 'DMRB Stage 3 Wider Study Area'
- An overview of the permanent and temporary works assessment boundaries applied in the assessment of the Proposed Scheme is provided in **Drawings 5.2** to **5.8**, contained in **Volume 3**. In those, a red line boundary delineates the proposed DMRB Stage 3 infrastructure design including all mainline, junction and drainage infrastructure, and watercourse diversions. This red line represents the 'Permanent Works' assessment boundary and includes the 5m offset from the design extents. Outwith the red line, a green line is shown in a number of areas; these have been considered as areas required to enable construction activities and are considered as the 'Temporary Works' assessment boundary. For the purposes of this chapter, this has been defined as the 'DMRB Stage 3 Detailed Study Area'

11.2.8 The study areas are shown in the **Water Features Plans, Drawings 11.1** to **11.7** (**Volume 3**).

11.2.9 For hydrological analysis of watercourses crossed by the Proposed Scheme, full catchments areas were considered beyond the outlined study area where applicable. These are shown on the **Surface Water Catchments, Drawing 11.8** (**Volume 3**).

11.2.10 There are a number of spatial constraints identified within the study area, including the River Truim, the Highland Mainline (HML) railway and a section of the BDL. Significant environmental constraints include internationally and nationally designated ecological sites, specifically the River Spey Special Area of Conservation (SAC) (which includes the River Truim), and the Drumochter Hills area which is also a designated SAC, Special Protection Area (SPA) and Site of Special Scientific Interest (SSSI). The Allt Dubhaig is of national interest for its fluvial (river) geomorphology and is a Geological Conservation Review Site (GCR). It is also the qualifying geodiversity feature of the Drumochter Hills SSSI. These are discussed in greater detail in **Chapter 12**.

Baseline data sources

Desk-based Study

11.2.11 Principal data sources were used to collate baseline information for water features within the study area including:

- Transport Scotland A9 Dualling: '*Strategic Environmental Assessment*' (SEA) – Environmental Report (2013)
- Transport Scotland A9 SEA Report Addendum Appendix F: '*Strategic Flood Risk Assessment*' (SFRA) (2013)
- Transport Scotland (2015) A9 Dualling – Glen Garry to Dalwhinnie DMRB Stage 2 Report, *Volume 1 – Part 3: Environmental Assessment, Chapter 10: Road Drainage and the Water Environment* (unpublished)
- Ordnance Survey (OS) 1:50,000 raster and 1:10,000 vector mapping
- Scottish Environment Protection Agency (SEPA) online Flood Maps (2014)
- SEPA River Basin Management Plans (RBMP)
- SEPA Sensitive Receptors GIS dataset
- Flood Estimation Handbook (FEH) CD-ROM v.3 (2009)
- Transport Scotland (2014) '*DMRB Stage 1 Assessment A9 Dualling: Preliminary Engineering Services*' (PES)
- British Geological Survey (BGS) GIS datasets of groundwater vulnerability classes and survey data (1:50,000 maps)
- Historical mapping
- GIS datasets of designated conservation areas, including SSSI, SPA and SACs (provided by Scottish Natural Heritage (SNH))
- Flow gauge data (provided by SEPA)
- SEPA online interactive Drinking Water Protection Areas (DWPA) mapping
- SEPA water chemistry data

11.2.12 As the River Truim is a tributary to the River Spey, an appreciation of the River Spey and wider Spey catchment was essential in informing impact assessments on the River Truim and its tributaries. A range of published reports was used to inform the assessment of baseline conditions (mainly relating to hydromorphology and flood risk), with key documents listed below:

- Cuthbertson and Partners - *'Flooding in Badenoch and Strathspey Flood Study for The Highland Regional Council*' (1990)
- Gemmell, S. L. G., Hansom, J. D., Hoey, T. B. - *'The geomorphology, conservation and management of the River Spey and Spey Bay SSSIs, Moray, Scottish Natural Heritage Research and Monitoring Report No 57*' (2001)
- Gilvear, D. J. - *'Patterns of channel adjustment to impoundment of the upper River Spey, Scotland between 1942 and 2000*' (2004)

- Werritty, A., Ferguson, R. I. - *'Pattern changes in a Scottish braided river over 1, 30, and 200 years*' (1980).

Site Walkovers and Surveys

11.2.13 A photogrammetry survey, carried out by 'Blom' for Transport Scotland in 2014, enabled identification of water features and crossing locations. This information was supplemented by site walkovers undertaken between March and October 2015 to refine information on culverts crossing the existing A9, watercourses, and geomorphic characteristics. Location-specific watercourse channel and hydraulic structure surveys were undertaken during May and June 2016.

Ground Investigation

11.2.14 Ground investigations (GI) have been undertaken for the Proposed Scheme, as described in **Chapter 10**. Relevant information from the GI regarding water table depth, groundwater quality, and superficial geology was used to inform the water environment assessment. A programme of additional ground and surface water quality monitoring is currently being undertaken.

Water Features Survey

11.2.15 The baseline assessment of water features was informed by a Water Features Survey (identifying key water features that may be affected by the Proposed Scheme via desktop studies and site walkovers), and a review of information obtained from sources described above.

11.2.16 Relevant baseline information on individual watercourses, drains, ponds, wetlands, springs, abstractions, discharges, and built structures (i.e. dams, reservoirs, aqueducts) has been recorded in a Water Features Schedule in **Appendix 11.1 (**contained in **Volume 2),** and accompanying Water Features Plan included in **Drawings 11.1** to **11.7 (Volume 3)**. This information and the three environmental parameters of Water Quality, Hydrology and Flood Risk are used to inform the assignation of sensitivity values to each watercourse within the study area which may be affected by the Proposed Scheme.

11.2.17 For the purposes of assessment, watercourses within the study area have been identified using OS mapping and classified as either 'Major Watercourses' (MW), or 'Minor Watercourses' (W):

- Major Watercourse – shown on 1:50,000 scale OS maps
- Minor Watercourse – shown on 1:10,000 scale OS maps or identified by the Blom survey and via site walkovers

11.2.18 Minor watercourses also include field drains and existing road drains which have been identified from topographical surveys and review of Transport Scotland records. All watercourse crossings of the existing A9 (i.e. via bridges and culverts) have been an assigned a 'Hydro ID' and are shown on **Drawings 11.1** to **11.7 (Volume 3)**. Those that do not cross the A9, but are still within the study area, are assigned a 'Major' (MW) or 'Minor' (W) water feature reference number only.

11.2.19 The water features schedule also identifies private water supply abstractions found within the study area and several private sewage discharges.

Scoping Out

11.2.20 An initial screening assessment was carried out to determine which of the waterbodies identified by the Blom survey were unlikely to be impacted by the Proposed Scheme. This reduced the number of potentially affected waterbodies within the study area from 192 to 85.

11.2.21 There are also numerous minor field or road drainage ditches which run parallel to, but do not cross, the existing A9 road corridor. These are likely to be affected by the widened road corridor. As they are man-made and do not exhibit significant hydrological/ ecological or other attributes (and will be replaced by a new drainage layout), they are not assessed further, i.e. are not subject to a pre-and post-mitigation assessment.

Procedure for assessing impacts

11.2.22 DMRB HD45/09 sets out a framework through which the assessment considers the attributes of water features in the existing natural water environment, and the potential impacts of the Proposed Scheme on them, in terms of magnitude and significance. The significance of any potential impact is a product of the sensitivity of the water feature (based on its importance) and the magnitude of the impact being considered.

11.2.23 HD45/09 sets out the procedures for assessing four principal areas as follows:

- Effects of Routine Runoff on Surface Waters
- Effects of Routine Runoff on Groundwater
- Pollution Impacts from Accidental Spillages
- Assessing Flood Impacts

11.2.24 For the purposes of the assessment the spatial extent considered when assigning magnitude and significance of impact relies on professional judgement. Some of the potential impacts will be limited to the vicinity of works; for example, bank protection will affect a small percentage of a watercourse's overall length. Others may have farther reaching effects, such as encroachment into the functional floodplain potentially affecting flood levels outwith the study area. These spatial factors are considered accordingly and reported where applicable. Cumulative impacts are considered separately in **Chapter 20**.

Water Quality

11.2.25 Potential water quality impacts have been assessed using the Highways Agency (now Highways England) Water Risk Assessment Tool (HAWRAT). HAWRAT is a Microsoft Excel tool designed to evaluate risks related to the intermittent nature of routine road runoff. It assesses the acute pollution impacts on aquatic ecology associated with soluble pollutants, and the chronic impacts associated with sediment-bound pollutants.

11.2.26 HAWRAT allows the user to assess the effect of potential impacts on water quality, as well as the effectiveness of any recommended mitigation measures, by predicting road runoff pollutant loading at each step of the assessment and comparing it against runoff specific thresholds (RSTs); for example, Environmental Quality Standards (EQSs) based on annual average concentrations. The relevant EQSs for the protection of freshwater aquatic life have been derived from SEPA's Supporting Guidance (WAT-SG-53). These are given as 1.0µg/l for copper and 11.9µg/l for zinc.

11.2.27 The DMRB method for assessing potential impacts of routine runoff to groundwater applies when there is direct discharge to groundwater; the methodology is based on a Source-Pathway-Receptor (S-P-R) protocol. Where all proposed road drainage outfalls discharge to surface water bodies, i.e. there are no direct discharges to groundwater, potential groundwater contamination has not been assessed.

11.2.28 In terms of accidental spillages, HAWRAT evaluates the risk of occurrence of an incident or event on the road network giving rise to toxic materials entering the water environment. It takes account of specific 'higher risk' features such as slip roads and junctions as well as traffic volumes using the road and the proportion of heavy good vehicles (HGVs). A more detailed description of the procedures for assessing water quality from HD45/09 is provided in the Water Quality Assessment in **Appendix 11.2** (**Volume 2**).

Hydrology and Flood Risk

11.2.29 Hydrological and hydraulic modelling has been carried out to predict flood water levels, assess flood impacts, and provide an estimate of compensatory flood storage requirements. Where embankments were shown to encroach on existing watercourse extents, suggesting a loss of existing channel and/ or functional floodplain, proposed earthworks have been refined to avoid unnecessary loss of conveyance or flood storage capacity. The results of the hydraulic modelling also informed the recommended flooding-related mitigation measures (e.g. culvert upsizing).

11.2.30 Understanding of baseline flood conditions has been enhanced using information derived from the development of a 2D flood model for the River Truim with additional 1D elements incorporated into the 2D model. Development for DMRB Stage 3 included updated surveyed river cross-sections and structures. The approach adopted for DMRB Stage 3 has been reviewed and accepted as appropriate by SEPA. Further detail of the hydrological and hydraulic modelling approach is provided in the Flood Risk Assessment (FRA) within **Appendix 11.3 (Volume 2).**

Hydromorphology

11.2.31 DMRB contains no specific procedures for assessing hydromorphological impacts; however, related targets for restoring and improving the natural water environment are established via the Water Environment and Water Services (Scotland) Act 2003 (WEWS). Assessment of the baseline hydromorphological processes and associated impacts has, therefore, been carried out using procedures developed from the following key reference documents:

- '*Assessing the Significance of Impacts - Social, Economic, Environmental - Supporting Guidance*' (WAT-SG-67) (SEPA), 2015
- '*Review of Impact Assessment Tool and Post Project Monitoring Guideline Report to SEPA by Haycocks Associates*', 2005 (WAT-SG-30)
- '*The Fluvial Design Guide*', Environment Agency (EA), 2009
- '*Guidebook of Applied Fluvial Geomorphology*', Department of Environment Food and Rural Affairs Technical Report TD1914 (DEFRA/EA), 2003

11.2.32 A Detailed Catchment Baseline Survey (DCBS), which included field-based river reconnaissance surveys, was carried out to enhance the desk-based studies. This established the current conditions of watercourses by assessing topography, hydrological regime, sediment processes and characteristics of the water environment. A more detailed description of the procedures and methodologies is provided in the Hydromorphology Assessment in **Appendix 11.4 (Volume 2).**

Consultation

11.2.33 Further input has been provided throughout the design process via consultation forums and an Environmental Steering Group (ESG) (which includes members of SEPA, SNH, The Highland Council (THC), Cairngorms National Park Authority (CNPA), and Historic Environment Scotland (HES)). The ESG helped develop a range of Strategic Environmental Design Principles that are consistent between projects across the A9 Dualling programme. Details of the Principles relevant to the water environment are provided in **Table 2.1.6** of **Appendix 2.1** (**Volume 2**).

11.2.34 Further consultation with additional relevant stakeholders (non-ESG members) including Spey District Fishery Board (SFB) and local resident groups has also been undertaken. Details of consultation processes are provided in **Chapter 7**.

Procedure for selection and impact evaluation of replacement watercourse crossings

11.2.35 All watercourse crossings have been designed and assessed individually, as well as cumulatively, to ensure any potentially adverse impacts are appropriately mitigated.

11.2.36 **Figure 11-1** outlines the decision-making process followed when considering the replacement or extension of existing crossings. The underlying aim has been, wherever possible, to maintain existing conveyance capacity to minimise loss of flood water storage, whilst considering potential for improvement at locations where existing infrastructure is constructed on the functional floodplain.

11.2.37 New crossings are designed to convey peak flows for a 200-year flood event. In recognition of predicted climate change effects, 20% is added to peak design flows. A freeboard allowance has also been included when assessing potential flood risk to sensitive receptors to cater for other hydrological and modelling uncertainties, and sufficient clearance has been provided between the design water level and the underside of structures to allow free passage of floating debris.

11.2.38 Where possible, opportunities have been taken to remove existing ecological, morphological, and hydrology/ flood risk pressures. Where no such design driver was identified at existing crossings, and a larger culvert was not required for other reasons, such as operational access, consideration was given to maintaining existing conveyance capacity and upstream flood storage. This has reduced the volume of compensatory flood storage required to offset loss of functional floodplain.

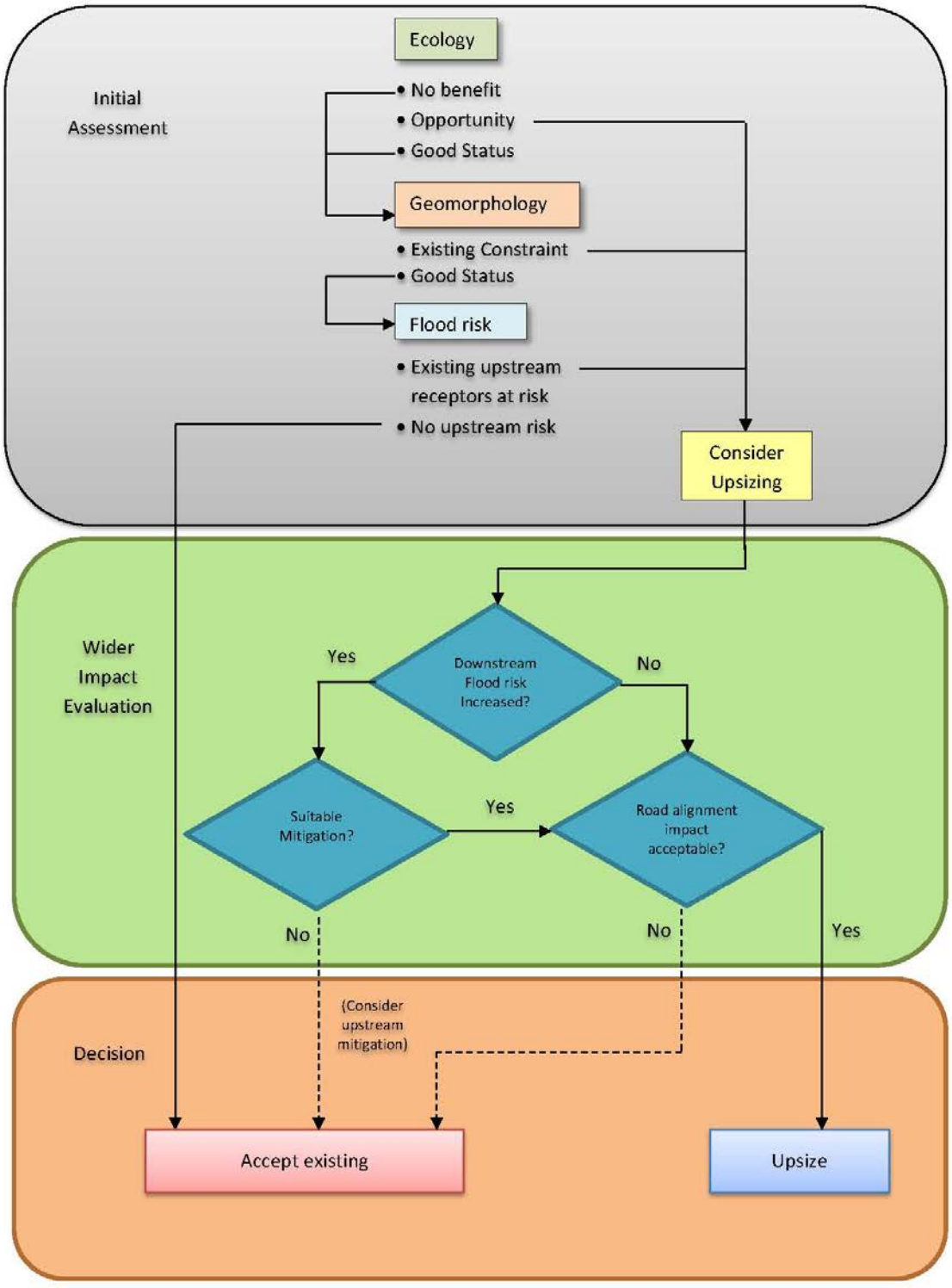


Figure 11-1: Flow chart of process for selection and impact evaluation of replacement watercourse crossings

Assigning values to water feature sensitivity, attributes and impacts

11.2.39 In accordance with HD45/09 water impact assessment, sensitivity values must be assigned to potentially affected water features and scheme-associated impacts.

11.2.40 Values for sensitivity are measured on a four-point scale from 'Low' to 'Very High'. Where more than one value is assigned to a single water feature reflecting different attribute sensitivities (i.e. water quality, hydrology and flood risk, hydromorphology), the corresponding value is used to determine the resulting significance of impact on that attribute.

11.2.41 A summary of the typical criteria/ indicator(s) of value considered when assigning sensitivity to affected water features is given in **Table 11- 1**. Magnitudes of potential impacts to water features are outlined in **Table 11- 2** and the resulting significance of impact is provided in **Table 11- 3**. A comprehensive list of sensitivities assigned to those water features subject to the impact assessment is provided in the Water Features Schedule of **Appendix 11.1 (Volume 2)**. Tables detailing the impact magnitude and significance values for the affected water features are provided in the relevant Appendices **(Appendices 11.2** to **11.4, Volume 2)**.

Table 11- 1: Water Feature Sensitivity

Sensitivity	Typical Criteria/ Indicator of Value
Very High	**Water quality** **Surface Water** – **Water Quality**: 'High' overall Water Framework Directive (WFD) water quality status. No, or a negligible number of, anthropogenic pressures and/ or pollutant sources affecting the water feature WFD status, and/ or potable water supply serving >10 properties in remote areas where there is no access to alternative supplies. – **Biodiversity:** 'High' overall WFD ecology status or for non-classified features, 'High' ecosystem quality, based on site observations and professional judgement. Presence of aquatic species and/ or habitats identified as important at an international scale. Protected/ designated site under EC or UK habitat legislation (e.g. SAC, SPA, Ramsar site), and/ or no existing pressures to biodiversity. **Groundwater** An aquifer constituting a valuable resource because of its high quality and/ or extensive exploitation for public, private domestic (i.e. serving >10 properties) or agricultural/ industrial use and/ or groundwater is classified as having very high groundwater vulnerability (BGS Vulnerability Class 5).
	Hydrology and Flood Risk Hydrologic importance to internationally designated sensitive ecosystems and/ or critical social and economic uses (e.g. water supply, abstraction, recreation, amenity). Water feature with direct flood risk to >100 residential properties or critical infrastructure (e.g. trunk road or mainline railway, hospitals, schools, safe shelters).
	Hydromorphology **Sediment Regime** – Water feature sediment regime provides a diverse mosaic of habitat types suitable for species sensitive to changes in sediment concentration and turbidity, such as migratory salmon, freshwater pearl mussels. Water feature appears in complete equilibrium with natural erosion and deposition occurring. The water feature has sediment processes reflecting the nature of the catchment and fluvial system. **Channel Morphology** – Water feature includes varied morphological features (e.g. pools, riffles, bars, natural bank profiles) with no sign of channel modification. **Natural Fluvial Processes** – Water feature displays natural fluvial processes and natural flow regime, which would be highly vulnerable to change as a result of modification.

Sensitivity	Typical Criteria/ Indicator of Value
High	**Water Quality** **Surface Water** – **Water Quality:** 'Good' overall WFD water quality status. A small number of anthropogenic pressures and/ or pollutant sources that do not significantly affect the water feature WFD status and/ or potable water supplies serving <10 properties in remote areas where there is no access to alternative supplies and/ or use of water for extensive agricultural purposes. – **Biodiversity -** 'Good' overall WFD ecology status or for non-classified features, 'Good' ecosystem quality, based on site observations and professional judgement. Presence of aquatic species and/ or habitats identified as important at a national scale. Protected/ designated site under EC or UK legislation (SAC, SPA, Ramsar, SPA) and few existing pressures to biodiversity. **Groundwater** An aquifer of limited value either because of quality impairment or because exploitation is not extensive (i.e. private domestic and/ or agricultural supply serving <10 properties) and/ or groundwater is classified to have high vulnerability (BGS vulnerability class 4).
	Hydrology and Flood Risk: Hydrologic importance to nationally designated ecosystems and/ or locally important social and economic uses (e.g. water supply, abstraction recreations, and amenity). Water feature with direct flood risk to 1 - 100 residential properties, >10 industrial premises, and/ or other land use of high value or indirect flood risk to critical infrastructure.
	Hydromorphology **Sediment Regime:** – Water feature sediment regime provides habitats suitable for species sensitive to changes in sediment concentration and turbidity, such as migratory salmon, freshwater pearl mussels. Water feature appears largely in natural equilibrium with some localised accelerated erosion and/ or deposition caused by land use and/ or modifications. Primarily the sediment regime reflects the nature of the natural catchment and fluvial system. **Channel Morphology:** – Water feature exhibiting a natural range of morphological features (e.g. pools, riffles, bars, varied natural river bank profiles), with limited signs of artificial modifications or morphological pressures. **Natural Fluvial Processes:** – Predominantly natural water feature with a diverse range of fluvial processes that is highly vulnerable to change as a result of modification.
Medium	**Water Quality** **Surface Water** – **Water Quality**: 'Moderate' overall WFD water quality status or not classified by SEPA. Likely to have deteriorated in water quality as a result of anthropogenic pressures and/ or pollutant sources and/ or potable water supplies, located within the vicinity of a mains water supply and/ or supplies used only for local agricultural purposes. – **Biodiversity**: 'Moderate' overall WFD ecology status or for non-classified features, 'Moderate' ecosystem quality, based on site observations and professional judgement. Likely to exhibit a limited number of regional designated ecosystems and/ or existing pressures which are likely to be affecting biodiversity. **Groundwater** Poor groundwater quality and/ or low permeability make exploitation of groundwater unlikely and/ or groundwater is classed as having moderate vulnerability (BGS vulnerability classes 2-3).
	Hydrology and Flood Risk Some but limited hydrologic importance to sensitive ecosystems and/ or social and economic uses Water feature with direct flood risk to agricultural or recreational land and/ or affecting <10 industrial premises and high value agriculture (e.g. arable pastures, complex cultivation patterns and agro-forestry).

Sensitivity	Typical Criteria/ Indicator of Value
	Hydromorphology **Sediment Regime** – Water feature sediment regime provides some habitat suitable for species sensitive to change in suspended sediment concentrations or turbidity. A water feature with natural processes occurring but modified, which causes notable alteration to the natural sediment transport pathways, sediment sources and areas of deposition. **Channel Morphology** – Water feature exhibiting some morphological features (e.g. pools, riffles and depositional bars). The channel cross-section is partially modified in places, with obvious signs of modification to the channel morphology. Natural recovery of channel form may be present (e.g. eroding cliffs, depositional bars). **Natural Fluvial Processes** – Water feature with some natural fluvial processes, including varied flow types. Modifications and anthropogenic influences having an obvious impact on natural flow regime, flow pathways and fluvial processes.
Low	**Water Quality** **Surface Water** – **Water Quality**: 'Poor/ Bad' overall WFD water quality status or not classified by SEPA. Highly likely to be affected by anthropogenic pressures and/ or pollution sources and/ or heavily engineered or artificially modified features (e.g. road and field drains, and ephemeral features) and/ or not used for water supplies – **Biodiversity**: 'Poor/ Bad' overall WFD ecology status or for non-classified features, 'Poor/ Bad' ecosystem quality, based on site observations and professional judgement. No habitats/ species of conservation and/ or any existing pressures which are considered to be adversely affecting biodiversity. **Groundwater** Very poor groundwater quality and very low permeability make exploitation of groundwater unfeasible. No known past or existing exploitation of this water body and/ or groundwater is classed as having low vulnerability (BGS vulnerability classes 0-1).
	Hydrology and Flood Risk Minimal hydrological importance to sensitive ecosystems and/ or social and economic uses. Water feature with little or no flood risk affecting land use or receptors (e.g. rough grazing land).
	Hydromorphology **Sediment Regime** – Water feature sediment regime which provides very limited physical habitat for species sensitive to changes in suspended solids concentration or turbidity. Highly modified sediment regime with limited/ no capacity for natural recovery. **Channel Morphology** – Water feature that has been extensively modified (e.g. by culverting, addition of bank protection or impoundments) and exhibits limited-to-no morphological diversity. The water feature is likely to have uniform flow, uniform banks and absence of bars. Insufficient energy for morphological change. **Natural Fluvial Processes** – Water feature which shows no or limited evidence of active fluvial processes with unnatural flow regime or/ and uniform flow types and minimal secondary currents.

Magnitude of Impact

11.2.42 The magnitude of a potential impact is determined by the effect the impact could have on the water feature or an associated attribute. Impacts may be beneficial or adverse and values range from 'Major Adverse' to 'Major Beneficial' as shown in **Table 11- 2** below.

Table 11- 2: Magnitude of Impact

Magnitude	Typical Criteria
Major Adverse	**Results in loss of attribute and/ or quality and integrity of the attribute.** **Water quality:** **Surface Water:** – Major shift away from baseline conditions such that change is likely to result in a downgrade in overall WFD water quality status and/ or total removal of the water feature's capacity to dilute pollutants and waste products and/ or loss or extensive change to a fishery, water supply or nature conservation site; and/ or – Failure of both soluble and sediment-bound pollutants in HAWRAT (Method A, Annex I) and compliance failure with EQS values (Method B). Calculated risk of pollution from a spillage >2% annually (Spillage Risk Assessment, Method D, Annex I). **Groundwater:** – Major shift away from baseline conditions such as loss of, or extensive change to, an aquifer or extensive change to groundwater supported designated species/ habitats or water supply; and/ or – Potential high risk of pollution to groundwater from routine runoff – risk score >250 (Groundwater Assessment, Method C, Annex I). Calculated risk of pollution from spillages >2% annually (Spillage Risk Assessment, Method D, Annex I).
	Hydrology and Flood Risk: Major changes to flow regime and catchment hydrology (i.e. decrease in conveyance capacity, loss in flood storage) and a major alteration to the catchment area. An increase in peak flood level (0.5% annual probability) >100mm.
	Hydromorphology: **Sediment Regime** – Significant impacts on the water feature bed, banks and vegetated riparian corridor resulting in changes to sediment characteristics, transport processes, sediment load and turbidity. This includes extensive input of sediment from the wider catchment due to modifications. Impacts would be at the waterbody scale. **Channel Morphology** – Significant/ extensive alteration to channel planform and/ or cross section, including modification to bank profiles or the replacement of a natural bed. This could include: significant channel realignment (negative); extensive loss of lateral connectivity due to new/ extended embankments; and/ or, significant modifications to channel morphology due to installation of culverts or outfalls. Impacts would be at the waterbody scale. **Natural Fluvial Processes** – Significant shift away from baseline conditions with potential to alter processes at the catchment scale.
Moderate Adverse	**Results in effect on integrity of attribute, or loss of part of attribute.** **Water quality:** **Surface Water:** – A moderate shift away from baseline conditions. Likely to result in a downgrade in overall water quality status. Partial loss in productivity of a fishery or water supply. Reduction in the water feature's capacity to dilute pollutants and waste products, and/ or – Failure of both soluble and sediment-bound pollutants in HAWRAT (Method A, Annex I) but compliance with EQS values (Method B). Calculated risk of pollution from spillages >1% annually and <2% annually. **Groundwater:** – A moderate shift away from baseline conditions. Partial loss or change to an aquifer. Partial loss of the integrity of groundwater supported designated species/ habitats or a water supply, and/ or – Potential medium risk of pollution to groundwater from routine runoff – risk score 150-250. Calculated risk of pollution from spillages >1% annually and <2% annually.
	Hydrology and Flood Risk: Moderate changes to the flow regime and catchment hydrology (i.e. decrease in conveyance capacity, loss in flood storage) and a moderate alteration to the catchment area. An increase in peak flood level (0.5% annual probability) >50mm.

Magnitude	Typical Criteria
	Hydromorphology: **Sediment Regime** – Some changes and impacts on the water feature bed, banks and vegetated riparian corridor resulting in some changes to sediment characteristics, transport processes, sediment load and turbidity. Impacts would be at the multiple reach scale. **Channel Morphology** – Some alteration to channel planform and/ or cross section, including modification to bank profiles or the replacement of a natural bed. Activities could include: channel realignment, new/ extended embankments, modified bed and/ or bank profiles, replacement of bed and/ or banks with artificial material and/ or installation of culverts. Impacts would be at the multiple reach scale. **Natural Fluvial Processes** – A shift away from baseline conditions with potential to alter processes at the reach or multiple reach scale.
Minor Adverse	**Results in some measurable change in attributes quality or vulnerability** **Water quality**: **Surface Water** – A minor shift away from baseline conditions. Slight reduction in the water feature's capacity to dilute pollutants and waste products. Likely to result in a slight decline in surface water quality with no associated impacts on designated species/ habitats or water supply and/ or – Failure of either soluble or sediment-bound pollutants in HAWRAT. Calculated risk of pollution from spillages >0.5% annually and <1% annually **Groundwater** – Minor shift away from baseline conditions. Likely to result in a slight decline in ground water quality with no associated impacts on groundwater supported designated species/ habitats or water supply, and/ or – Potential low risk of pollution to groundwater from routine runoff – risk score <150. Calculated risk of pollution from spillages >0.5% annually and <1% annually. Minor effects on groundwater supported wetlands.
	Hydrology and Flood Risk: Minor changes to the flow regime and catchment hydrology (i.e. decrease in conveyance capacity, loss in flood storage) and a minor alteration to the catchment area. An increase in peak flood level (0.5% probability) >10mm.
	Hydromorphology: **Sediment Regime** – Limited impacts on the water feature bed, banks and vegetated riparian corridor resulting in limited (but notable) changes to sediment characteristics, transport processes, sediment load and turbidity at the reach scale. **Channel Morphology** – A small change or modification in the channel planform and/ or cross section. Includes upgrade to and/ or extension of existing watercourse crossing and/ or structure with associated minor channel realignment with localised impacts. **Natural Fluvial Processes** – Minimal shift away from baseline conditions with typically localised impacts up to the reach scale.
Negligible	**Results in effect on attribute but of insufficient magnitude to affect the use or integrity.** **Water quality**: **Surface Water:** – No perceptible changes to baseline conditions. No measureable change in water quality. No change in the water feature's capacity to dilute pollutants and waste products, and/ or – No risk identified by HAWRAT. Risk of pollution from spillages <0.5%. **Groundwater:** – No perceptible changes to baseline conditions. No measureable change in groundwater quality, and/ or – No measurable impact upon an aquifer and risk of pollution from spillages <0.5%.

Magnitude	Typical Criteria
	Hydrology and Flood Risk: Negligible changes to the flow regime (i.e. changes that are within the range of accepted modelling uncertainty) and catchment hydrology (i.e. conveyance capacity, loss in flood storage) and a negligible alteration to the catchment area. Negligible change in flood risk to sensitive receptors i.e. < +/- 10mm change in peak flood level (0.5% annual probability).
	Hydromorphology: Minimal or no measurable change from baseline conditions in terms of sediment transport, channel morphology and natural fluvial processes. Any impacts are likely to be highly localised and not have an effect at the reach scale.
Minor Beneficial	**Results in some beneficial effect on attribute or a reduced risk of negative effect occurring.** **Water quality:** **Surface Water:** – Minor improvement over baseline conditions, and/ or **Groundwater:** – Minor improvement over baseline conditions, and/ or – Calculated reduction in existing spillage risk by 50% or more to an aquifer (when existing spillage risk <1% annually).
	Hydrology and Flood Risk: Minor improvement over baseline conditions involving a reduction in peak flood level (0.5% annual probability) >10mm.
	Hydromorphology: **Sediment Regime** – Partial improvement to sediment processes at the reach scale, including reduction in siltation and localised recovery of sediment transport processes. **Channel Morphology** – Partial improvements including enhancements to in-channel habitat, riparian zone and morphological diversity of the bed and/ or banks. **Natural Fluvial Processes** – Slight improvement on baseline conditions with potential to improve flow processes at the reach scale.
Moderate Beneficial	**Results in moderate improvement of attribute quality** **Water quality:** **Surface Water:** – A moderate improvement over baseline conditions. **Groundwater:** – A moderate improvement over baseline conditions, e.g. calculated reduction in existing spillage risk by 50% or more (when existing spillage risk is >1% annually).
	Hydrology and Flood Risk: Moderate improvement over baseline conditions involving a reduction in peak flood level (0.5% annual probability) >50mm.

Magnitude	Typical Criteria
	Hydromorphology: **Sediment Regime** – Reduction in siltation and recovery of sediment transport processes at the reach or multiple reach scale. **Channel Morphology** – Partial creation of both in-channel and vegetated riparian habitat. Improvement in morphological diversity of the bed and/ or banks at the reach or multiple reach scale. Includes partial or complete removal of structures and/ or artificial materials. **Natural Fluvial Processes** – Notable improvements on baseline conditions and recovery of fluvial processes at the reach or multiple reach scale.
Major Beneficial	**Results in major improvement of attribute quality** **Water quality:** **Surface Water:** – Major improvement over baseline conditions. – Removal of existing polluting discharge, or removing the likelihood of polluting discharges occurring to a watercourse. **Groundwater:** – Major improvement over baseline conditions. – Removal of existing polluting discharge to an aquifer or removing the likelihood of polluting discharges occurring. Recharge of an aquifer.
	Hydrology and Flood Risk: Major improvement over baseline conditions involving a reduction in peak flood level (0.5% annual probability) >100mm.
	Hydromorphology: **Sediment Regime** – Improvement to sediment processes at the catchment scale, including recovery of sediment supply and transport processes. **Channel Morphology** – Extensive creation of both in-channel habitat and riparian zone. Morphological diversity of the bed and/ or banks is restored, such as natural planform, varied natural cross-sectional profiles, recovery of fluvial features (e.g. cascades, pools, riffles, bars) expected for river type. Removal of modifications, structures, and artificial materials. **Natural Fluvial Processes** – Substantial improvement on baseline conditions at catchment scale. Recovery of flow and sediment regime.

Assigning Significance of Impact

11.2.43 The significance of a potential impact on the water feature is a product of the sensitivity of the water feature and the magnitude of the potential impact. Values can range from 'Neutral' to 'Very Large' (**Table 11- 3**) and impacts may be considered 'Adverse' or 'Beneficial' depending on the sensitivity of the attribute and the magnitude of impact associated with the Proposed Scheme.

Table 11- 3: Significance of Impact

Magnitude of impact / Sensitivity of attribute	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

11.2.44 Significance is not absolute and where two options are available, the selection is based on professional judgement defined in relation to individual assets and their context and location. A higher level of significance is generally attached to large-scale impacts and impacts on highly sensitive or sensitive receptors; thus moderate magnitude impacts on highly sensitive receptors can be more important than major impacts on less sensitive receptors. Professional judgement is required to make a balanced and objective assessment taking all of these factors into account.

Limitations to the Assessment

11.2.45 There are certain limitations within each discipline with regards to assessment methodologies, as outlined below.

Water Quality

11.2.46 Regional surface water quality data was obtained from SEPA for the DMRB Stage 3 Assessment, surface and groundwater quality monitoring has been established via Ground Investigation works, during the DMRB Stage 3 process; however, at the time of writing, no further specific information is presently available for the watercourses within the Proposed Scheme extent. Similarly, the majority of local watercourses do not have a WFD classification, and therefore inferences regarding water quality are made based on other environmental factors. Where WFD classifications are available, a summary of these is provided in **section 11.3**.

11.2.47 DMRB methods are used to assess the effects of routine runoff on surface water and the impact of accidental spillages. Application of the surface water quality impact assessment methods set out in HD45/09 relies heavily on the use of HAWRAT. The following limitations associated with the use of HAWRAT have been identified:

- Water hardness data from surface water sampling was not available for the assessment and was assumed to be the lowest value available within the HAWRAT programme
- HAWRAT relies on three rainfall data sites in Scotland – Edinburgh, Paisley and Ardtalnaig near Aberfeldy (all some distance from the study area) – sensitivity analysis has been undertaken to cater for the absence of data from rainfall sites within the Study Area and is reported in **Appendix 11.2** (**Volume 2**)
- HD33/16 provides removal efficiencies for input into HAWRAT; these are used indicatively rather than prescriptively. Required treatment percentages returned by HAWRAT are precise and may not take full account of site specific water feature attributes or characteristics; whereas published guidance providing accurate or robust treatment efficiencies for the available SuDS treatment options when used in series is limited. HD45/09 states:

"…a degree of pragmatism will be required when designing a drainage system to meet the required treatment percentages. The treatment train should be sufficient to reasonably treat the runoff."

Hydrology and Flood Risk

11.2.48 Compensatory storage has not been modelled due to the complexity and uncertainty associated with representing this effectively in hydraulic models. These uncertainties are recognised in the Technical Flood Risk Guidance for Stakeholders (SEPA, 2015) and a volume-slices approach to evaluate compensatory storage is suggested. This method has been employed and accepted by SEPA, and is described in greater detail, along with limitations relating to modelling uncertainties in **Appendix 11.3** (**Volume 2**).

Hydromorphology

11.2.49 Limitations to the hydromorphology assessment method used are as follows:

- The method used assumes that the works cause a change in WFD status classification of the waterbody, when in reality, the works are unlikely to cause a change in most cases
- Not all waterbodies have a current WFD classification, therefore, for many tributaries this has been assumed based on that of the larger river downstream classified by SEPA
- The length of channel affected by the works is based on a combination of the known length of direct impact, but the length of indirect impacts has been estimated based on expert judgement rather than carrying out sediment transport modelling

11.3 Baseline Conditions

Introduction

11.3.2 Baseline conditions describe the current environmental state of the water features within the study area without the construction and operation of the Proposed Scheme. A full list of watercourses identified in the study area is provided in the schedule of the Water Features Survey, along with sensitivity values for those watercourses subject to the pre- and post-mitigation assessment (**Appendix 11.1, Volume 2**). These watercourses are shown in the Water Features Plans (**Drawings 11.1** to **11.7, Volume 3**).

11.3.3 Many of the watercourses within the Proposed Scheme extent have been scoped-out of the environmental assessment, as explained in **section 11.2**, therefore only baseline conditions of those watercourses within the study area considered to be directly impacted by the Proposed Scheme are provided below.

11.3.4 All watercourses that cross the A9 are referred to by a water features reference number (i.e. 'Major' (MW) or 'Minor' (W)) and crossing structures (i.e. bridge or culvert) are given a specific Hydro ID reference number. Watercourses that do not cross the A9, but are still within the study area, are assigned a water feature reference number only.

11.3.5 Sensitive receptors are noted within the baseline assessment as they are considered to be determining factors within the existing water environment likely to be affected by, or affect, the Proposed Scheme.

Water Framework Directive

11.3.6 The WFD aims to improve and protect the water environment. Future targets include: prevent deterioration and enhance status of aquatic ecosystems, including groundwater; promote sustainable water use; reduce pollution; contribute to the mitigation of floods and droughts.

11.3.7 River Basin Management Plans (RBMPs) were produced as a requirement of the WFD, by which statutory objectives, based on ecological assessments and economic judgments, are set for Scottish waters, and cover all types of water body (e.g. rivers, lochs, lakes, estuaries, coastal waters and groundwater). The RBMPs also:

- describe the current condition of our water bodies
- identify where current or historic activities are reducing the quality of the water bodies
- describe the actions required to ensure our designated waters of special value (for example, drinking waters, shellfish waters, bathing waters, and waters designated for their plants and animals) are up to required standards
- describe the actions needed to deliver environmental improvements over the next 6 years, and longer to 2027

11.3.8 The baseline information and WFD classifications are, therefore, used to ensure the Proposed Scheme will not have a deleterious/ detrimental effect on the WFD status of watercourses within the study area.

Common Baseline Conditions

11.3.9 The criteria under which the watercourse baselines are established, and against which the Proposed Scheme is assessed, are similar for many of the minor watercourses in the study area. Therefore, a general 'Common Baseline Conditions' description is provided for surface and ground water quality, hydrology and flood risk, and hydromorphology; thereafter, specific attributes are described under 'Specific Baseline Conditions' with individual headings for major watercourses and other notable water features.

Surface Water Quality

11.3.10 As noted in **section 11.2**, no surface water quality data or WFD classification was available for this DMRB Stage 3 Assessment for many of the watercourses in the Proposed Scheme extent. Therefore, inferences regarding water quality have been made based on other environmental factors.

11.3.11 All watercourses in the Proposed Scheme extent flow through heterogeneous land cover types including some or all of the following: heather, rough grassland, heathland, peat, areas of coniferous woodland (plantations), and mires/ bogs/ fens. Therefore, the water quality of these watercourses may be impacted by acidification. All watercourses will also receive a degree of road runoff from the existing A9 which may impact on water quality. It has been assumed that larger tributaries with good connectivity to the River Garry and River Truim may support salmon species and so a conservative estimation of their water quality sensitivity has been adopted.

Groundwater Quality

11.3.12 The groundwater quality assessment has been undertaken using BGS vulnerability classes. This approach amalgamates large spatial extents into common classes and has, therefore, been

delineated and reported in **Table 11- 4** by chainage (ch.), rather than individual surface water features as elsewhere in this chapter. The groundwater vulnerability class associated to each individual watercourse is provided in the Water Features Schedule (**Appendix 11.1**, **Volume 2**).

Table 11- 4: Summary of Groundwater Vulnerability

Chainage (ch.)	Vulnerability class
> -0,500	Vulnerability class 3 – Vulnerable to some pollutants, but only when they are continuously discharged/ leached
-0,500 to -0,260	Vulnerability class 4a – Vulnerable to those pollutants not readily adsorbed or transformed. Less likely to have clay present in superficial deposits (therefore, generally higher vulnerability than 4b)
-0,010 to 0,250	Vulnerability class 3
0,250 to 0,370	Vulnerability class 4a
0,370 to 1,960	Vulnerability class 3
1,960 to 1,990	Vulnerability class 4a
1,990 to 2,030	Vulnerability class 5 – Vulnerable to most pollutants, with rapid impact in many scenarios
2,030 to 2,125	Vulnerability class 4a
2,125 to 2,620	Vulnerability class 3
2,610 to 2,680	Vulnerability class 4a
2,680 to 2,850	Vulnerability class 3
2,850 to 3,050	Vulnerability class 2 – Vulnerable to some pollutants, but only when they are continuously discharged/ leached
3,050 to 3,680	Vulnerability class 3
3,680 to 4,850	Vulnerability class 4a
4,850 to 5,125	Vulnerability class 5
5,125 to 9,750	Vulnerability class 4a

Hydrology and Flood Risk

11.3.13 Flooding from the River Garry and River Truim is extensive throughout the study area for the 1 in 200 return year period. The floodplains of both rivers potentially impact upon residential and non-residential properties, critical infrastructure (A9, HML railway), and sensitive environmental receptors identified by SEPA with potential economic implications e.g. local agricultural land. Where applicable, flood risk from tributaries is discussed individually in the sections below.

Hydromorphology

11.3.14 The majority of the minor watercourses in the Proposed Scheme extent have relatively short longitudinal profiles, ranging from a few hundred metres to approximately 1km, with largely straight channel planforms and with confluence elevations ranging from 480m at the River Truim confluence within the Drumochter Pass, to 410m above Ordnance Datum (AOD) at the confluence of the River Garry.

11.3.15 Many of the minor watercourse channels are narrow (i.e. between 0.5 and 1.5m wide), with few exhibiting significant geomorphic diversity. The terrain is dominated by heather, grassland and bog mosaics. On gentler gradients in close proximity to the A9, watercourses flow through established channels, both engineered and/ or following natural gradients over vegetation, where there is some deposition of small-grained materials, i.e. sands and silts.

Specific Baseline Conditions

Major Watercourses

River Garry (MW 7.1)

11.3.16 The River Garry is a major tributary of the River Tummel and River Tay, as shown in **Drawing 11.1** (**Volume 3**). It generally flows in a south-easterly direction via Glen Garry before discharging into Loch Faskally (National Grid Reference (NGR) 292314, 758586) and the River Tummel (NGR 293578, 757756).

11.3.17 The Garry is fed by a series of tributaries which originate from the west of the Grampian Mountains and cross underneath the A9. The water body has been designated as a heavily modified water body (HMWB) on account of physical alterations that cannot be addressed without a significant impact on water storage for hydroelectricity generation. It has a WFD (2015) classification of "*'Bad ecological Potential' – from Garry Intake to Errochty Water confluence",* due to pressures including; water abstraction, water storage and barriers to fish migration; therefore, it has been assigned a **Low** sensitivity value for water quality.

11.3.18 BGS data indicates that the waterbody is predominantly within a high groundwater vulnerability classification zone (Class 4); therefore, a **High** sensitivity value has been assigned.

11.3.19 The River Garry and its upper tributaries support important but limited populations of Atlantic salmon (*Salmo salar*). The watercourse has been assessed as having **High** sensitivity to water quality in terms of biodiversity for the factors described above. The watercourse is sinuous in planform, and varied hydromorphological features such as pools, riffles and bar development are evident. The restriction of natural sediment supply is associated with the dam intake; therefore the watercourse has been assessed as having a **High** sensitivity value in terms of hydromorphology.

11.3.20 The hydraulic model results indicate that a local access bridge crossing of the River Garry is likely to contribute to the 200 year flood envelope encroaching in the vicinity of Dalnaspidal Cottage. There is also an area of encroachment and overtopping of the HML railway predicted for the 200 year event. The River Garry has therefore been assigned a **Very High** sensitivity value for hydrology and flood risk.

Allt Chaorach Mor (Hydro ID -3/ MW 7.24)

11.3.21 Allt Chaorach Mor is a tributary of the River Garry with a catchment size of 1.09km² and a length of approximately 1.5km, flowing in a south-westerly direction from its source within the foothills of the Grampian Mountains, as shown in **Drawing 11.1** (**Volume 3**). It flows under the A9 and the HML railway before discharging into the River Garry at approximately NGR 265818, 772356.

11.3.22 The watercourse is considered likely to receive some untreated/ partially treated road drainage from the A9 and is not known to support any important species or habitats. It has therefore, been assigned a **Medium** sensitivity value for water quality and biodiversity.

11.3.23 BGS data indicates that this waterbody is predominantly within a high groundwater vulnerability classification zone (Class 4); therefore, a **High** sensitivity value is assigned.

11.3.24 Extensive sediment supply has been transported from the upper catchment and deposited along the channel, as evidenced by the braiding, pools and riffles. There is also evidence of hard engineering both in the form of bed armouring and bank reinforcements. Based on these hydromorphological characteristics an overall sensitivity value of **High** has been assigned.

11.3.25 The DMRB Stage 3 flood model indicates that during a 1:200 year event adjacent uncultivated agricultural land is at risk, thus it has been assigned a **Low** sensitivity value for hydrology and flood risk.

Photograph 11-1: Allt Chaorach Mor (Hydro ID -3, MW 7.24)

a) Upstream view east from A9

b) Downstream looking at A9 from east

Allt Chaorach Beag (Hydro ID -2/ MW 7.25)

11.3.26 Allt Chaorach Beag is a tributary of the River Garry with a catchment size of 0.4km² and a length of approximately 1.5km, flowing in a southerly direction from its source adjacent to the Craig Chaorach foothill of the Grampian Mountains, as shown in **Drawing 11.1** (**Volume 3**). It flows under the A9 and the HML railway before discharging into the River Garry at approximately NGR 265594, 772362.

11.3.27 The watercourse is considered likely to receive some untreated/ partially treated road drainage from the A9 and not known to support any important species or habitats and, therefore, has been assigned a **Medium** sensitivity value for water quality and biodiversity.

11.3.28 BGS data indicates that this waterbody is predominantly within a high groundwater vulnerability classification zone (Class 4); therefore, a **High** sensitivity value is assigned.

11.3.29 The channel has been heavily modified with stone bank revetment and concrete lining upstream and downstream of the channel. Extensive sediment supply has been transported from the upper catchment and deposited along the channel as evidenced by the braided planform, and pools and riffles. Based on these hydromorphological characteristics an overall sensitivity value of **High** has been assigned.

11.3.30 The DMRB Stage 3 flood model indicates that during a 1:200 year event the Allt Chaorach Mor is only at risk of flooding uncultivated agricultural land hence it has been assigned a **Low** sensitivity value for hydrology and flood risk.

Photograph 11-2: Allt Chaorach Beag (Hydro ID -2, MW7.25)

a) Downstream view west of A9

b) HML railway crossing

Allt Dubhaig (MW7.2)

11.3.31 The Allt Dubhaig is formed at the confluence of the Allt a'Chaorainn and Allt Coire Dhomhain, and it flows in a southerly direction before discharging into the River Garry at NGR 263108, 775321 as shown in **Drawings 11.2** and **11.3** (**Volume 3**). The Allt Coire Dhomhain has a WFD Overall Classification of 'Poor Status' (2015). The Allt Dubhaig has therefore been assigned a **Low** sensitivity value for water quality and biodiversity.

11.3.32 The BGS data indicates that the Allt Dubhaig is within a high groundwater vulnerability zone (Class 4) and therefore, it has been assigned a **High** groundwater sensitivity value.

11.3.33 The Allt Dubhaig is a Geological Conservation Review (GCR) site associated with an alluvial fan feature and progressive changes in planform ranging from braided to sinuous channel types. The only modification which is noted on the watercourse is the presence of a bridge at Dalnaspidal Lodge which spans the watercourse and has the potential to restrict flows upstream of the structure. The Allt Dubhaig has therefore, been classified as **High** sensitivity value in terms of hydromorphology.

11.3.34 The DMRB Stage 3 hydraulic model indicates that during a 1:200 year flood event the HML railway is susceptible to direct flood risk from the Allt Dubhaig, therefore this watercourse has been assigned a **Very High** sensitivity value for hydrology and flood risk.

Allt Coire Mhic-sith (Hydro ID 2/ MW7.3)

11.3.35 Allt Coire Mhic-sith is a tributary of the River Garry with a catchment size of approximately 7.2km² and a length of 5km, flowing in a south-westerly direction from its source at Glas Mheall Beag in the foothills of the Grampian Mountains, as shown in **Drawing 11.1** (**Volume 3**). The watercourse flows underneath the existing A9, a section of access track, HML railway and flows adjacent to the settlement of Dalnaspidal. It receives a point source discharge from Station Cottages, which provides a potential source of pollutant that may affect water quality, which has been assigned a **Medium** sensitivity value.

11.3.36 BGS data indicates that the Allt Coire Mhic-sith has a moderate groundwater vulnerability classification (Class 3); therefore, the waterbody has been assigned a **Medium** sensitivity value.

11.3.37 The abstraction return flow from the Dalnacardoch Hydropower Generating Scheme, upstream of the A9, may impact on the natural hydrology of the watercourse as well as its pollutant dilution/ dispersal capacity. There is extensive sediment supply available from the catchment and incision

downstream of the crossing results in a debris fan feature where the slope reduces. The watercourse has been assigned a **High** hydromorphology sensitivity value due to these contributing factors.

11.3.38 The DMRB Stage 3 hydraulic model indicates that the adjacent Dalnaspidal farm buildings are potentially at risk from a 1:200 year flood event. The Allt Coire Mhic-sith hydro scheme abstraction provides a hydrological function for local social and economic use. Therefore, a **High** sensitivity value been assigned for hydrology and flood risk.

Photograph 11-3: Allt Coire Mhic-sith (Hydro ID 2/ MW 7.3)

a) Downstream view of channel modifications west of A9

b) Upstream view of the Hydropower Scheme east of A9

Allt Ruidh nan Sgoilearnan (Hydro ID 8/ MW 7.4)

11.3.39 Allt Ruidh nan Sgoilearnan is a tributary of the Allt Dubhaig, with a catchment size of approximately 0.2km² and a length of 1.23km, flowing in a south-westerly direction as shown in **Drawing 11.2** (**Volume 3**). It is likely to receive some pollutants in the form of untreated/ partially treated road runoff, and there are existing pressures from engineering at the inlet and outlet which are likely to affect biodiversity; therefore, water quality and biodiversity have been assigned **Medium** sensitivity values.

11.3.40 BGS data indicates that Allt Ruidh nan Sgoilearan has a very high groundwater vulnerability (Class 5); therefore, it has been assigned a **Very High** groundwater quality sensitivity value.

11.3.41 The watercourse flows underneath access tracks, the existing A9 and the HML railway prior to discharging at the confluence with Allt Dubhaig at NGR 263620, 773848. Sediment is generated from incision upstream of the crossing, and downstream the there is evidence of incision, bank erosion and lateral migration. The watercourse has therefore been assigned a **High** hydromorphology sensitivity value.

11.3.42 The DMRB Stage 3 hydraulic model indicates that during a 1:200 year event the Allt nan Sgoilearan could potentially pose an indirect flood risk to the HML railway, therefore it has been assigned a **High** sensitivity value for hydrology and flood risk.

Photograph 11-4: Allt Ruidh nan Sgoilearnan (Hydro ID 8/ MW 7.4)

a) Upstream view east of A9, showing evidence of deposition

b) Downstream view west of A9, showing bank erosion and lateral migration

Unnamed Watercourse (Hydro ID 12/ MW 7.5)

11.3.43 The unnamed watercourse is a short tributary of Allt Dubhaig, which has a catchment size of approximately 0.04km² and a length of 450m, as shown in **Drawing 11.2** (**Volume 3**). The watercourse crosses underneath the existing A9, National Cycle Network 7 (NCN7) cycle path and HML railway. It is likely to receive some pollutants in the form of untreated/ partially treated road runoff; therefore, water quality and biodiversity have been assigned **Medium** sensitivity values.

11.3.44 There is damaged bed armouring where the channel is vertically unstable, and there has been an adjustment to a more stable bed slope at the crossing upstream and downstream. This evidence of accelerated incision may be due to increases in discharge due to felling and other anthropogenic influences within the catchment. Given that there is evidence of natural fluvial and morphological features, as well as modifications and anthropogenic influences, a **Medium** sensitivity value has been assigned for hydromorphology.

11.3.45 The DMRB Stage 3 hydraulic model indicates that, during a 1:200 year flood, Hydro ID 12 inundates uncultivated agricultural land, thus it has been assigned a **Low** sensitivity value for hydrology and flood risk.

Photograph 11-5: Unnamed Watercourse (Hydro ID 12/ MW 7.5)

a) Upstream view of damage to bed armouring east of A9

b) Downstream view west of A9 showing evidence of incision

Allt Fuar Bheann (Hydro ID 13/ MW 7.6)

11.3.46 Allt Fuar Bheann is a tributary of Allt Dubhaig, with a catchment size of approximately 0.7km² and a length of 1.82km originating from its source within the foothills of the Grampian Mountains, as shown in **Drawing 11.2** (**Volume 3**). It is likely that the Allt Fuar Bheann receives some untreated or partially treated road runoff and therefore has been assigned a **Medium** water quality sensitivity value.

11.3.47 BGS data indicates that the watercourse is within a very high groundwater vulnerability zone (Class 5) and, therefore, has been assigned a very **High** sensitivity for groundwater quality.

11.3.48 The watercourse crosses beneath General Wade's Military Road, the existing A9, the NCN7 footpath and the HML railway before discharging at the confluence at NGR 263429, 774571. There is evidence of sediment transport through the A9 and NCN7 crossings, with deposition downstream of the railway crossing in the form of an alluvial fan. Lateral channel migration is also evident downstream of the A9, where no bank protection is in place. The watercourse has therefore been assigned a **High** sensitivity value for hydromorphology.

11.3.49 The DMRB Stage 3 hydraulic model indicates that during a 1:200 year flood event the Allt Fuar Bheann could potentially pose an indirect flood risk to the HML railway, hence it has been assigned a **High** sensitivity value for hydrology and flood risk.

Photograph 11-6: Allt Fuar Bheann (Hydro ID 13/ MW 7.6)

a) Upstream view east of A9, showing evidence of bank protection

b) Downstream view west of A9 showing evidence of lateral channel migration

Allt a' Chaorainn (Hydro ID 23/ MW 7.9)

11.3.50 Allt a Chaorainn has a catchment size of approximately 3km² and a length of 3.12km, flowing in a westerly direction before discharging at the confluence with the Allt Dubhaig at NGR 263108, 775332, as shown in **Drawing 11.3** (**Volume 3**). It is likely that the watercourse intercepts some road runoff at the road crossing, and therefore, has been assigned a **Medium** water quality sensitivity value.

11.3.51 BGS data indicates that the Allt a' Chaorainn is situated within a very high groundwater vulnerability zone (Class 5) and therefore has been assigned a **Very High** groundwater quality sensitivity value.

11.3.52 There is evidence of localised erosion directly upstream and downstream of the crossing providing a local sediment source. A downstream crossing is also fixing channel bed and bank positions, creating a large step in the channel bed and causing incision. There is a large supply of sediment generated from the steep slopes in the upper Allt a' Chaorainn catchment in the vicinity of the A9 crossing location. There is evidence of morphological diversity (vertical incision, deposition and lateral migration of the channel) outwith the engineered crossing section; therefore overall, the Allt a' Chaorainn has been assigned a **High** sensitivity value for hydromorphology.

11.3.53 The DMRB Stage 3 hydraulic model indicates that during a 1:200 year flood the Allt a' Chaorainn is associated with direct flooding of the HML railway; therefore it has been assigned a **Very High** sensitivity value for hydrology and flood risk.

Photograph 11-7: Allt a Chaorainn (Hydro ID 23/ MW 7.9)

a) Upstream view east of the A9, showing bed and bank protection

b) Downstream view west of A9 showing bed protection

c) Downstream view west of A9

Unnamed Watercourse (MW 7.10)

11.3.54 The short unnamed watercourse has a length of approximately 400m and discharges into the Allt Dubhaig at NGR 263107, 775325, as shown in **Drawing 11.3** (**Volume 3**). It is likely that the watercourse intercepts some road runoff at the road crossing, and therefore has been assigned a **Medium** water quality sensitivity value.

11.3.55 BGS data indicates that the watercourse is situated within a medium groundwater vulnerability zone (Class 3) and therefore has been assigned a **Medium** groundwater quality sensitivity value.

11.3.56 The watercourse is shown to be incised and meandering, with evidence of deposition bars and pools and riffles in places. A **High** sensitivity value has been assigned to hydromorphology for this unnamed watercourse.

11.3.57 The DMRB Stage 3 hydraulic model indicates that during a 1:200 year flood event the HML railway is at risk of inundation from MW 7.10, therefore it has been assigned a **Very High** sensitivity value for hydrology and flood risk.

River Truim (MW 8.1)

11.3.58 The River Truim is a major watercourse throughout the Proposed Scheme extent as shown in Drawings **11.4 to 11.7** (**Volume 3**). It is a tributary of the River Spey draining the western edges of the Cairngorms Mountains with a catchment area of 125km^2. Its headwaters are situated in the Pass of Drumochter, approximately 8km south of Dalwhinnie. It has a WFD *(2015)* classification of "*'Good ecological potential' – from source to Allt Cuaich confluence"*, and "*'Moderate ecological potential' – lower catchment"*.

11.3.59 It is designated as part of the River Spey SAC) for its populations of Atlantic salmon (*Salmo salar*) (the Truim is noted as important for its salmonid smolt production), and otter (*Lutra lutra*). Sea lamprey (*Petromyzon marinus*) and freshwater pearl mussel (*Margaritifera margaritifera*) are also qualifying features of the River Spey SAC; no evidence has been determined in the River Truim Proposed Scheme extents; however, their presence has been assumed for assessment purposes. It is situated in the Cairngorms National Park and its source is also within the Drumochter Hills SSSI/ SPA/ SAC, as discussed in **Chapter 12**. The watercourse has been assessed as having **Very High** sensitivity value.

11.3.60 The River Truim exhibits a natural range of morphological features (e.g. pools, riffles, bars, varied natural river bank profiles), with limited signs of artificial modifications or morphological pressures. A **High** sensitivity value has therefore, been assigned to hydromorphology for the watercourse.

11.3.61 The DMRB Stage 3 hydraulic model indicates that during a 1:200 year flood event the embankment of the HML railway and existing A9 is at risk of inundation from the River Truim, therefore it has been assigned a **Very High** sensitivity value for hydrology and flood risk.

Allt an Creagach (Hydro ID 31/ MW 7.11)

11.3.62 The Allt an Creagach has a catchment size of approximately 0.823km² and a length of 2.1km, which generally flows in a westerly direction, passing underneath the A9 and the HML railway prior to its discharge into the River Truim at NGR 262795, 776313, as shown in **Drawings 11.3** and **11.4** (**Volume 3**). It is likely that the watercourse intercepts some road runoff at the road crossing, and therefore has been assigned a **Medium** water quality sensitivity value.

11.3.63 The BGS data indicates that the Allt an Creagach crossing of the existing A9 is situated within a high groundwater vulnerability zone (Class 4) and therefore it has been assigned a **High** sensitivity value.

11.3.64 There is a large sediment supply associated with the steep catchment slopes, and the watercourse crossing is situated in the vicinity of an active alluvial fan depositional feature, therefore, a **High** sensitivity value has been assigned for hydromorphology.

11.3.65 The DMRB Stage 3 hydraulic model indicates that the Allt an Creagach overtops and floods the existing A9 and HML railway during the 1:200 year flood event, hence it has been assigned a **Very High** sensitivity value for hydrology and flood risk.

Photograph 11-8: Allt an Creagach (Hydro ID 31/ MW 7.11)

a) Upstream view east of A9, showing evidence of bed protection

b) Downstream view west of A9

Unnamed Watercourse (MW 7.19)

11.3.66 This unnamed watercourse is a small tributary of Allt Coire Dubhaig, which flows from a pond in a north-westerly direction for approximately 500m via a forestry plantation prior to its confluence at NGR 263016, 779504, as shown in **Drawing 11.6** (**Volume 3**). A point source discharge from Drumochter Lodge (DISC 7.8) is located downstream; therefore a **Medium** sensitivity value has been assigned for water quality.

11.3.67 Sediment has been supplied in the upper catchment and transported downstream, depositing in a series of bars where the slope becomes reduced. A **High** sensitivity value has therefore been assigned for the hydromorphology of the unnamed watercourse.

11.3.68 The DMRB Stage 3 hydraulic model indicates that during a 1:200 year event, this watercourse is associated with direct flood risk to the existing A9 carriageway; therefore it has been assigned a **Very High** sensitivity value for hydrology and flood risk.

Allt Coire Chaorainn (Hydro ID 52/ MW 7.18)

11.3.69 The Allt Coire Chaorainn has a catchment area of approximately 3.461km² and a length of 3.37km, flowing in a north-easterly direction underneath the Drumochter Lodge access track, the existing A9, and General Wade's Military Road before discharging into the River Truim at NGR 262793, 779739, as shown in **Drawing 11.6** (**Volume 3**). The Allt Coire Chaorainn receives a point source discharge from Drumochter Lodge (DISC 7.8), and is likely to receive some untreated or partially treated runoff from the existing A9; therefore, a **Medium** sensitivity value has been assigned for water quality.

11.3.70 The watercourse is situated within a high groundwater vulnerability zone (Class 4) and therefore, has been assigned a **High** groundwater quality sensitivity value.

11.3.71 There is evidence of active morphological processes across the catchment, and an alluvial fan is situated immediately upstream of the watercourse crossing which is associated with potential risk for channel migration; therefore a **High** sensitivity value has been assigned for the hydromorphology. The Allt Coire Chaorainn provides a locally important social use given that it is as utilised as surface water abstraction (private water supply) for Drumochter Lodge.

11.3.72 The DMRB Stage 3 hydraulic model indicates that during a 1:200 year event, it is associated with direct flood risk to the existing A9 carriageway; therefore it has been assigned a **Very High** sensitivity value for hydrology and flood risk.

Photograph 11-9: Allt Coire Chaorainn (Hydro ID 52/ MW 7.18)

a) Upstream view east of A9

b) Downstream view west of A9, showing areas of deposition

Unnamed Watercourse (Hydro ID 57/ MW 7.20)

11.3.73 The unnamed watercourse has a catchment area of approximately 0.545km² and a length of 1km, generally flowing in a westerly direction, crossing under the existing A9 and NCN7 cycle track before discharging into the River Truim at NGR 263080, 780415, as shown in **Drawing 11.6** (**Volume 3**). It is likely that the watercourse will receive some form of untreated or partially treated road runoff, and has been assigned a **Medium** water quality sensitivity value.

11.3.74 BGS data indicates that this watercourse is situated within a high groundwater vulnerability zone (Class 4) and has therefore, been assigned a **High** groundwater quality sensitivity value.

11.3.75 There are artificial channel modifications in the form of bank protection at the crossing inlet. The upstream channel is incised and confined by valley sides in some locations with potential for future erosion and sediment delivery; therefore, a **Medium** sensitivity value has been assigned for the hydromorphology.

11.3.76 The DMRB Stage 3 hydraulic model indicates that during a 1:200 year event Hydro ID 57 is associated with flood risk to the existing A9 embankment, thus a **High** sensitivity value has been assigned for hydrology and flood risk.

Photograph 11-10: Unnamed Watercourse (Hydro ID 57/ MW 7.20)

a) Upstream view east of A9, showing bank protection

b) Downstream view west of A9

Allt Coire Chuirn (Hydro ID 59/ MW 7.22)

11.3.77 The Allt Coire Chuirn has a catchment area of approximately 3.602km² and a length of 4.3km, generally flowing in a north-westerly direction, crossing under the existing A9 and NCN7 before discharging into the River Truim at NGR 263167, 780815, as shown in **Drawing 11.6** (**Volume 3**). A **High** sensitivity value has been assigned for both water quality and biodiversity, given that there are likely to be only a small proportion of pollutant sources and as ecological permeability is facilitated within the span bridge crossing.

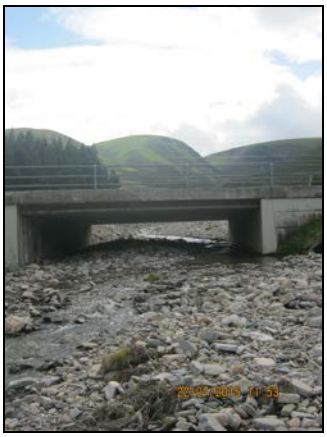
11.3.78 BGS data indicates that the Allt Coire Chuirn is situated within a high groundwater vulnerability zone (Class 4); therefore, it has been assigned a **High** groundwater quality sensitivity value.

11.3.79 The Allt Coire Chuirn is located within a steep sided V-shaped valley and an extensive sediment supply from the upper catchment is transported and deposited along a major alluvial fan. The fan is largely contained within the channel, which helps contribute towards active morphological processes and further sediment production. The existing A9 crossing creates a pinch-point which restricts the passage of sediment and debris movement; therefore, a **High** sensitivity value has been assigned for the hydromorphology.

11.3.80 The DMRB Stage 3 hydraulic model indicates that the Allt Coire Chuirn is associated with inundation of the A9 embankment during a 1:200 year event, and therefore it has been assigned a **High** sensitivity value for hydrology and flood risk.

Photograph 11-11: Allt Coire Chuirn (Hydro ID 59/ MW 7.22)

a) Upstream view east of A9, showing areas of sediment deposition



b) Downstream view west of A9, showing pinch-point to sediment movement

Allt Coire Bhotie (Hydro ID 64/ MW 7.23)

11.3.81 The Allt Coire Bhotie has a catchment area of approximately 1.363km² and a length of 3.1km, generally flowing in a north-westerly direction, crossing under the existing A9 before discharging into the River Truim at NGR 263676, 781545, as shown in **Drawing 11.7** (**Volume 3**). A **High** sensitivity value has been assigned for water quality given that there are likely to be only a small proportion of pollutant sources relative to watercourse flow.

11.3.82 BGS data indicates that the Allt Coire Bhotie is situated within a high groundwater vulnerability zone (Class 4); therefore, it has been assigned a **High** groundwater quality sensitivity value.

11.3.83 The Allt Coire Bhotie receives sediment supply from hillslope failure locations upstream, transported along a steep, confined channel. There is an area of sediment deposition adjacent to a section of channel realignment. Erosion downstream of the crossing has also resulted in channel incision and bank collapse; a **High** sensitivity value has been assigned for the hydromorphology of the Allt Coire Bhotie.

11.3.84 The DMRB Stage 3 hydraulic model indicates that the Allt Coire Bhotie is associated with inundation of the A9 embankment during a 1:200 year event, and therefore it has been assigned a **High** sensitivity value for flood risk.

Photograph 11-12: Allt Coire Bhotie (Hydro ID 64, MW7.23)

a) Upstream view east of A9, showing areas of sediment deposition adjacent to channel realignment

b) Downstream view west of A9, showing bank collapse and a channel bar

Other Water Features

Private Water Supplies

11.3.85 Private water supplies (PWS) are identified within the Project 7 extent and are deemed to be of high sensitivity as they support vital social/ economic use. They include supplies at:

- Dalnaspidal Lodge, Possible Well (ABS 7.7) (ch. 0,100)
  - Historical mapping dated between 1900 and 1974 indicated the presence of a well approximately 35m to the west of the existing A9 at ch. 100 near Dalnaspidal. Subsequent CFJV walkover surveys (August 2016 and June 2017) also identified a manhole cover corresponding to the approximate location of the well, but that was unable to be opened and inspected (**Drawing 11.1, Volume 3**).
- Dalnaspidal Lodge, Dalnaspidal, PWS abstraction from borehole (ABS 7.6) (ch. 0,350)
  - Information received from P&KC and SEPA identified a PWS record supplying properties at and surrounding Dalnaspidal Lodge, located between 150 and 320m to the west of the existing A9 from ch. 200 to ch. 350. This was indicated to be sourced from a borehole located 370m west of the Highland Mainline railway at ch. 250. Consultation with HighWater (Scotland) Ltd provided additional information that the borehole is in fact located approximately 10m west of the Highland Mainline railway and that this feeds five properties at Dalnaspidal. The well is approximately 15m in depth and two submersible pumps within it deliver water to a storage tank via a treatment system (contained within a shed adjacent to Allt Coire Mhic Sith (264505, 773205)) for colour reduction and pH elevation. A booster pump set then delivers the treated water to the properties (**Drawing 11.1, Volume 3**).
- Dalnaspidal Lodge Supply, PWS abstraction from surface water (Allt Coire Mhic-sith (ABS 7.4) (ch. 0,400))
  - Information received from P&KC identified a PWS record supplying properties at and surrounding Dalnaspidal Lodge, located between 150 and 320m to the west of the existing A9 from ch. 200 to ch. 350. This was indicated to be sourced from the Allt Coire Mhic-sith

watercourse adjacent to the east side of the existing A9 at ch. 0,400 (**Drawing 11.1, Volume 3**).

- Dalnaspidal Lodge Supply, PWS abstraction from surface water (Allt Coire Mhic-sith (ABS 7.5) (ch. 0,400))
  - Information received from P&KC identified a PWS sourced from the Allt Coire Mhic-sith watercourse and supplying The Old Schoolhouse and Station Cottage properties at Dalnaspidal. Resident consultation and feedback confirmed this, identifying the supply to be sourced from the watercourse on the east side of the existing A9 at ch. 400 and that the water is utilised for domestic and consumption purposes (**Drawing 11.1, Volume 3**).
- Balsporran Cottages, PWS abstraction from spring (ABS 7.2) (ch. 6,800)
  - Information received from THC identified a PWS sourced from a spring, supplying Balsporran Cottage, an associated guesthouse and bed and breakfast. Resident consultation confirmed this, with the spring/ stream source located approximately 400m west of the existing A9 carriageway in the Pass of Drumochter beyond the Highland Mainline railway at ch. 6,800 and supplying the domestic property and four letting rooms within the bed and breakfast (**Drawing 11.5, Volume 3**).
- North Drumochter Lodge, PWS abstraction from a spring (at Allt Coire Chaorainn (ABS 7.3) (ch. 7,300))
  - Information received from THC identified an active PWS record supplying the properties/ buildings at Drumochter Lodge in the Pass of Drumochter for use within a deer larder and for domestic purposes. Landowner consultation identified that the supply is sourced from a spring, located approximately 320m to the east of the existing A9 at ch. 7,050. The spring tank capture system has been utilised to supply these properties for in the region of 100 years (**Drawing 11.6, Volume 3**).

Discharges

11.3.86 Consented point source discharges are identified from CAR licence information received from SEPA (**Table 11- 5**). They include private residential and commercial discharge of septic tank effluent (STE) to soakaways or surface watercourses. Although many are outwith the 'DMRB Stage 3 Detailed Study Area' they are considered here as they are located in the vicinity of watercourses identified as part of the baseline assessment and may have potential hydraulic connectivity to these via subsurface flows.

Table 11- 5: Licenced Discharges within Project 7 Extent

Water Features Ref.	Discharge	Chainage (approx.)	Position and Distance from Scheme	Drawing Number (in Volume 3)
DISC 7.1	Dalnaspidal Lodge, Ben Alder Estate, Calvine STE to Soakaway	ch. 0,100	340m south-west	11.1
DISC 7.2	Dalnaspidal, Calvine, Pitlochry STE to soakaway	ch. 0,275	220m south-west	11.1
DISC 7.3	Dalnaspidal Farm Buildings, Pitlochry STE to Soakaway	ch. 0,300	195m south-west	11.1
DISC 7.4	Dalnaspidal Steading, Dalnaspidal, Calvine, Pitlochry STE to soakaway	ch. 0,340	195m south-west	11.1
DISC 7.5	Station Cottages, Point source discharge, receiving water Allt Coire Mhic-sith	ch. 0,600	55m west	11.1

Water Features Ref.	Discharge	Chainage (approx.)	Position and Distance from Scheme	Drawing Number (in Volume 3)
DISC 7.7	Balsporran Cottages, Dalwhinnie STE to soakaway	ch. 6,850	100m west	11.5
DISC 7.8	Drumochter Lodge, Dalwhinnie STE to Soakaway	ch. 7,350	50m east	11.6

Key Receptors

11.3.87 Key sensitive receptors have been identified using a SEPA GIS receptor data shapefile. The vulnerability and sensitivity of receptors are also evaluated in line with the Scottish Planning Policy (SPP) Risk Framework. In terms of road drainage and the water environment, the key sensitive receptors within the study area extent that may be affected by the Proposed Scheme include: residential and non-residential properties; roads; railway lines; utilities; environmental designated sites; cultural heritage; community services; and agricultural land.

11.3.88 Specific receptors identified as potentially being at risk of flooding are: the HML railway (potentially at risk of fluvial flooding from tributaries of the River Truim and River Garry at numerous crossing locations); properties including Dalnaspidal Lodge, Balsporran Cottages and Drumochter Lodge are also identified to be potentially at risk of flooding.

11.3.89 Dalnaspidal Lodge itself is potentially at risk of flooding from Hydro ID 1, and the land adjacent to Balsporran Cottages and Drumochter Lodge are at risk of flooding from the River Truim and its tributary (Hydro ID 52 Allt Coire Chaorainn), respectively. These are shown in the Flood Extent Plans (**Drawings 11.11** to **11.18, Volume 3**). Further detail of sensitive receptors is provided in the Flood Risk Assessment of **Appendix 11.3** (**Volume 2**).

11.3.90 As critical infrastructure, the A9 itself is also identified as a sensitive receptor. The Proposed Scheme is designed to ensure there is no increased flood risk to the new road compared to the existing, and that is remains operational during an extreme event.

11.3.91 As SPP requires that no increase in flood risk occurs elsewhere as a result of the Proposed Scheme, areas outwith the water environment study area boundary are therefore considered as part of the FRA (**Appendix 11.3, Volume 2**).

Assigned Sensitivities

11.3.92 As previously described, water feature sensitivity is derived from the importance of associated attributes. Whilst all water features do not have the same specific attributes, values have been assigned under the following principal headings as described in **section 11.2**:

- Water quality (including groundwater): Water supply, and biodiversity
- Hydrology/ flood risk: Catchment characteristics, environmental, economic and social value, flow conveyance and flood storage potential
- Hydromorphology: Sediment regime, channel morphology and fluvial processes

11.3.93 A detailed breakdown of individual watercourses and their associated attribute sensitivities is provided in the schedule of the Water Features Survey (**Appendix 11.1, Volume 2**). Where more than one value is assigned to a single water feature, the relevant value of the associated attribute is assumed when determining the resulting significance of impact.

11.3.94 The potential impacts on each water feature vary across the Proposed Scheme dependent on the activity and specific attribute sensitivity assigned to each. These are discussed in more detail in **section 11.4**.

11.4 Potential Impacts

11.4.1 This section describes the potential impacts on the water environment that may arise as a result of the Proposed Scheme. Potential impacts to the Proposed Scheme itself as a result of water environment processes/ conditions (e.g. potential undermining of a road embankment by a watercourse in the medium to longer-term), and recommendations for routine and periodic operational-phase monitoring, are reported where relevant in the appropriate appendices.

Construction activities

11.4.2 Engineering works associated with the water environment include; construction of new/ replacement/ extended crossings of the A9 mainline (46 No.) and access tracks (11No.) via pipes (900 to 1500mmø) and box culverts (1500x1000mm to 3000x1500mm); earthworks associated with road widening; 149 watercourse realignments upstream and downstream of the Proposed Scheme mainline and access tracks; replacement of five mainline bridge structures; 13 SuDS basins/ ponds and associated outfalls; drainage channels and associated outfalls; stepped channels or cascades; and compensatory flood storage areas to offset floodplain encroachments.

Embedded mitigation

11.4.3 Throughout the DMRB Stage 3 iterative design process, a number of environmentally-led workshops considered each aspect of the developing design and made recommendations for certain features to be included in the next design iteration. These aspects have been defined as 'embedded mitigation' and, where they are included in the Proposed Scheme design, they are considered within the context of the impact assessment as providing mitigation to avoid or reduce potential environmental impacts outlined in the section above, and in some cases, provide environmental benefits.

11.4.4 With respect to the topics under consideration in this chapter, potential impacts associated with trunk road schemes are outlined in **Table 11- 6**, with details of embedded mitigation developed during design process (now incorporated into the Proposed Scheme) also provided. While the impact assessment is undertaken in cognisance of the embedded mitigation features, in order to ensure that all project mitigation requirements (including embedded, specific and generic mitigation) are captured, they have been included within **section 11.5**, and the Schedule of Environmental Commitments contained in **Chapter 21**.

Table 11- 6: Potential Impacts and Embedded Mitigation

Potential Impacts	Embedded Mitigation
Water Quality	
• A wide range of pollutants can affect the water environment (e.g. soluble metals, suspended solids, organic materials, salts, rubber, plastics, grit, rust and metal filings) and pose a potentially hazardous threat to the environment as a result of increases in runoff volumes and predicted future traffic volumes. • The potential impact from drainage maintenance (e.g. cleaning of gully pots) has been identified as being as potentially damaging as some spillage impacts. • Maintaining verge and central reservation vegetation growth with the potential use of herbicides may also contribute to contamination of road runoff. The routine application of road salt for de-icing (winter maintenance) could also impact adversely on downstream watercourse ecology, either directly through road surface drainage outfalls, or indirectly through groundwater.	• All un-kerbed roads are provided with 'over-the-edge' drainage via filter drains (or conveyance swales) providing source control and first treatment stage; • Watercourse capacity (Q_{95}) assessed for pre-selection of outfall locations during SuDS design for avoidance of potential impact on smaller watercourses (i.e. watercourses with less dilution/ removal of waste products capacity); • SuDS have been located outside flood extents (1 in 30 year for outfalls; 1 in 200 year for earthworks where possible) to minimise impacts on the water environment (avoids risk of overtopping and wash out of contaminated material); • Additional (enhanced) treatment is provided where required to satisfy the water quality assessment (HAWRAT); • Where infiltration has been assessed as inappropriate as a form of treatment, SuDS are lined to prevent groundwater contamination • Inclusion of spillage containment features in SuDS facilities (emergency shut-off valve on basin outlet) to minimise spillage risk to receiving watercourses • Porous surface at carpark providing treatment via cellular system of single sized stones (pea gravel) and filter drain
Hydrology and Flood Risk	
• An increase in impermeable area and reduction in infiltration capacity will increase overall runoff discharging to receiving watercourses. • The hydrology of watercourses may also become more 'flashy' compared to pre-scheme conditions, heightening hydrograph peak and increasing downstream flood risk and stream power. Road drainage too, will discharge to specified watercourses via an outfall. If attenuation is not suitably designed into the drainage system this may also have an impact on the hydrology and flood regime of receiving watercourses. • Floodplain storage may be reduced if there is encroachment by embankments, structures or earthworks. This loss would result in additional volumes of water potentially flooding areas elsewhere. Structures and culverts may restrict or increase conveyance causing water to back up and increase flood risk upstream, or facilitate greater flows to pass, thus increasing flood risk downstream. This is of particular concern if sensitive receptors have been identified either upstream or downstream of the Proposed Scheme. • Construction in floodplains can affect the nature and extent of the flood envelope in the area of construction and for some distance upstream and downstream. This could have a serious impact on property owners within or near the floodplain, who may become exposed to a new or increased risk of flooding. Bridges and embankments in particular, can obstruct or change the path of floodwaters, thereby changing the shape and/ or extent of the flood envelope.	• Upsizing culverts for watercourse crossings to a minimum of 900mm, reducing the risk of blockage; • Upsizing culverts for watercourse crossings to have capacity for the 200yr design event including a freeboard allowance (where culverts are below 1200mm in height the freeboard is to be 300mm, otherwise freeboard is set to one quarter of the height); • Raising road levels to accommodate for these increases (minimum of 2m above culvert crowns) and also provide greater freeboard above the functional floodplain; • Providing SuDS to mitigate increased surface runoff; • Compensatory storage areas are included to offset any flood storage volume lost due to encroachments (mainline, access, SuDS) into the functional floodplain; • Re-grading of certain cutting and embankment slopes to reduce floodplain encroachment; • SuDS have been sized to control (attenuate and store) significant rainfall up to the 0.5% AEP (1 in 200 year return period) event whilst restricting outflow to 'greenfield' runoff rates • Dispersal trenches to maintain groundwater supply to potentially sensitive habitats

Potential Impacts	Embedded Mitigation
Hydromorphology	
• Permanent loss of natural bed form where pipe culverts replace a natural (adjustable) channel bed and where outfall headwalls and bank protection works occur, reducing the morphological diversity of the channel and altering sediment supply at the location of engineering works, as well as downstream • The permanent loss of natural bank form through installation of erosion protection, head walls, channel realignment and culverts, impacting the channel where banks are currently natural in form. The loss of natural bank form can result in reduced sediment supply from these areas which may impact processes and morphological diversity at both the site of works and downstream reaches • Culverts, bank protection, headwalls and bridges all involve fixing the current position of the channel (planform and vertical), limiting the channel's ability to respond to environmental change through channel adjustment. This may result in scour to the engineered structures and bed, potentially altering current processes and sediment regime, reducing the resilience of the channel to future changes in water and sediment inputs (climate and/ or land use change) • All anticipated types of works have the potential to alter flow conditions (discharge and velocity, as well as flow patterns) within the channels. Changes from natural to engineered channels (addition/ extension of culverts, realignments, bridges) have a local adverse impact on flows in the waterbodies. Similarly, the outfalls and other areas where water is diverted across catchments alter the natural discharge of the channels, changing flow, sediment regime and potential processes away from the existing • Significant steps (such as catchment pits, weirs), culverts and channel diversions have the potential to alter the continuity of sediment transfer by causing excessive erosion or deposition • Works may alter the sediment inputs to the channel, as well as changing the movement of sediment within the waterbody resulting in a change to sediment dynamics and natural processes within the channel at the location of the works and in the reaches downstream • Excessive erosion of the proposed infrastructure (mainline or track embankments) has the potential to generate excessive sediment (as more sediment is available from the embankment than would be from the channel banks), and change patterns of deposition within the channels. Conversely areas of bank protection stop the inputs of sediment to the channel from erosion, also changing sediment dynamics	• Design bridges and culvert inlets/ outlets to require minimum scour protection • Ensure low flow channels to maintain minimum depth of water • Setting back of structures from river banks to allow natural channel migration and encourage sediment transfer through the catchment • Watercourse realignments designed with improved sinuosity to mimic natural sediment regime/ morphological conditions and encourage establishment of natural sediment transfer/ processes • Cascades follow natural topography where possible • Inclusion of scour pools upstream and downstream of steep culverts to dissipate energy • Reduce upstream erosion to improve stability of channels • Considered positioning of access tracks to improve watercourse morphology

Other Design Drivers Considered

11.4.5 Other design drivers also considered when developing the Proposed Scheme include:

- Operational factors (i.e. where maintenance issues require upsizing of culverts to ensure inspection and/ or debris removal can be carried out effectively)
- Ecological permeability (i.e. widening of underpasses with installation of dry ledges above extreme (normally 1 in 50yr) flood levels, and inclusion of natural bed materials to ensure that permeability throughout the route is maintained and improved where possible)

Specific Construction-phase Activities

11.4.6 **Table 11- 7** provides an outline of the specific construction-phase activities within the Proposed Scheme extent on or near the major watercourses described in **section 11.3**. Additional information regarding construction-phase (temporary) works is provided in **Chapter 5**.

11.4.7 **Table 11- 8** outlines the proposed SuDS treatments for the Project 7 drainage networks. Further detail on the impermeable and permeable areas associated with road runoff from the Proposed Scheme is provided in **Appendix 11.2**. Note: the permanent or operational-phase SuDS components should not be used to manage construction runoff.

Table 11- 7: Summary of specific construction-phase activities on or near major water features

Water Feature	Chainage (ch.)	Construction Activity
Allt Chaoreach Mor (MW7.24/ Hydro ID -3)	N/A	No construction works are planned on or near this watercourse
Unnamed (tributary of Allt Chaorach Beag) (MW7.25/ Hydro ID-2)	N/A	No construction works are planned on or near this watercourse
River Garry (MW7.1)	N/A	No construction works are planned on or near this watercourse
Allt Dubhaig (MW7.2)	N/A	No construction works are planned on or near this watercourse (however, cognisance regarding the sensitivity of Allt Dubhaig as a GCR site should be taken into account during construction and appropriate mitigation should be implemented)
Allt Coire Mhic-sith (MW7.3/ Hydro ID 2)	0,400	Road widening and earthworks associated with the new A9 southbound carriageway and Dalnaspidal Junction. Removal of existing and construction of new Allt Coire Mhic-sith underbridge, and construction of access track underbridge to the west
Allt Ruidh nan Sgoilearan (MW7.4/ Hydro ID 8)	1,500	Road widening and earthworks associated with the new A9 southbound carriageway Extension of 1500mm x 1250mm culvert (length = 40.54m) with natural bed material to be included in culvert and provision of mammal crossing. Open channel (step channel) down cut slope to culvert inlet. Upstream and downstream watercourse diversions.
Unnamed watercourse (tributary of Allt Dubhaig) (MW7.5/ Hydro ID 12)	1,875	Road widening and earthworks associated with new A9 northbound carriageway. Extension of 1500mm culvert (length = 31.35m) with natural bed material to be included in culvert. Upstream and downstream watercourse diversions.
Allt Fuar Bheann (MW7.6/ Hydro ID 13)	2,030	Road widening and earthworks associated with the new A9 northbound carriageway. Extension of 2400mm x 1800mm culvert (length = 30.3m) with natural bed material to be included in culvert and provision of mammal crossing. Stepped channel down on the downstream side.
Allt a'Chaorainn (MW7.9/ Hydro ID 23)	3,000	Road widening and earthworks associated with the new A9 southbound carriageway. Removal of existing and construction of new Allt a'Chaorainn underbridge
Unnamed watercourse (tributary of Allt Dubhaig) (MW7.10)	N/A	No construction works are planned on or near this watercourse

Water Feature	Chainage (ch.)	Construction Activity
River Truim (MW 8.1)	N/A	No construction works are planned on or near this watercourse
Allt an Creagach (MW7.11/ Hydro ID 31)	3,775	Road widening and earthworks associated with the new A9 southbound carriageway. Extension of 2700mm x 2100mm culvert (length = 37.28m) with natural bed material to be included in culvert and provision of mammal crossing.
Unnamed watercourse (tributary of River Truim) (MW7.19)	N/A	No constructions works are planned on or near this watercourse
Allt Coire Dubhaig/ Allt Coire Chaorainn (MW7.18/ Hydro ID 52)	7,200	Road widening and earthworks associated with the new A9 northbound carriageway. Removal of existing and construction of new Allt Coire Dubhaig underbridge, and construction of new NCN7 structure to the west.
Unnamed (tributary of River Truim) (MW7.20/ Hydro ID 57)	7,900	Road widening and earthworks associated with the new A9 northbound carriageway. Extension of 2400mm x 1800mm culvert (length = 51.55m) with natural bed material to be included in culvert and provision of mammal crossing.
Allt Coire Chuirn (MW7.22/ Hydro ID 59)	8,400	Road widening and earthworks associated with the new A9 carriageway. Removal of existing and construction of new Allt Chuirn Underbridge, replacement of existing Beauly-Denny access track crossing to the east, and construction of NCN7 structure to the west.
Allt Coire Bhotie (north) (MW7.23/ Hydro ID 64)	9,300 & 9,375	Road widening and earthworks associated with the new A9 southbound carriageway. Removal of existing and construction of new Allt Coire Bhotie underbridge, and replacement of Beauly-Denny access track to the east.

Table 11- 8: Summary of proposed SuDS features for drainage networks

Network	1st Level SuDS	2nd Level SuDS	Inclusion of Micro-pool	Outfall Form	Outfall receiving water	Outfall Co-ordinates	
						Easting	Northing
000	Filter Drain	Basin	No	Swale	Allt Chaorach Beag	265634	772530
001	Filter Drain	Basin	Yes	Swale	Unnamed (W7.1)	264686	773114
003	Filter Drain	Basin	Yes	Swale	Unnamed (W7.1)	264686	773114
004	Filter Drain	Basin	Yes	Swale	Allt Coire Mhic-sith (MW7.3)	264561	773260
020	Filter Drain	Basin	Yes	Swale	Allt Fuar Bheann (MW7.6)	263541	774594
042	Filter Drain	Basin	Yes	Swale	Unnamed (W7.101)	262879	776702
060	Filter Drain	Basin	No	Swale	Unnamed (W7.9)	262585	778515
063	Filter Drain	Basin	No	Swale	River Truim	262633	778774
065	Filter Drain	Basin	Yes	Swale	River Truim	262714	778926
Balsporran car park	Porous cellular system filled with single sized stone	Filter Drain	No	Pipe	Unnamed (W7.150)	262806	779192
069	Filter Drain	Basin	No	Swale	Unnamed (W7.15)	262852	779326

Network	1st Level SuDS	2nd Level SuDS	Inclusion of Micro-pool	Outfall Form	Outfall receiving water	Outfall Co-ordinates	
						Easting	Northing
077	Filter Drain	Basin	Yes	Swale	River Truim	262986	780161
083	Filter Drain	Basin	No	Swale	Unnamed (W7.19)	263198	780475
092	Filter Drain	Basin	Yes	Swale	Allt Coire Bhotie (MW7.23)	263697	781490
102*	Filter Drain	Tank sewer & vortex separator	No	Swale	Unnamed watercourse	263893	781991

*Note: The tank sewer and vortex separator are included in the Project 7 design as a temporary measure to provide sufficient treatment should Project 7 be constructed prior to Project 8. In actuality, it is likely both will be constructed as one and this section of road will drain north, tying into the Project 8 drainage network, and discharge into Allt Coire nan Cisteachan (MW8.5) via a SuDS basin. However; for assessment purposes, both Project 7 and Project 8 have to be considered independently and sufficient measures to treat runoff provided in each.

Potential Operational-phase Impacts

11.4.8 All potential impacts have been assessed using the methods outlined in **section 11.2**. A summary of potential impacts discussed in **Appendices 11.2 – 11.4** is provided below. Only impacts with significance greater than Neutral (adverse or beneficial) are included in **Table 11- 9**, with a summary of the sensitivity, magnitude of impact, and significance of impacts outlined also provided. Additional information regarding all operational-phase (permanent) works is provided in **Chapter 5**.

Water Quality

11.4.9 No potential impact to water quality or adverse effects on aquatic ecology has been identified for individual SuDS outfalls, as sufficient embedded mitigation has been incorporated into the Proposed Scheme design. Therefore, an overall **Neutral** significance has been determined. Further details are provided in **Appendix 11.2**. Further details are provided in **Appendix 11.2** (**Volume 2**).

Water Quality (Groundwater)

11.4.10 With appropriate embedded mitigation (e.g. lining SuDS to prevent dispersal of potentially polluted road runoff to ground), groundwater quality not be adversely impacted as a result of routine runoff or accidental spillage. Furthermore, the risk of accidental spillage is significantly below the '1 in 200 year' threshold set by HD45/09.

Hydrology

11.4.11 Seven watercourse catchments will be altered in size by the drainage layout and watercourse diversions required by the Proposed Scheme and a greater than Neutral significance of impact has been determined. The majority of the proposed works will be carried out on small watercourses/ earthworks ditches that have minimal hydrological importance to sensitive ecosystems and/ or social and economic uses. Therefore, these watercourses have been assigned **Low** sensitivities in terms of hydrology. Overall, the potential impact for these

watercourses is assessed as **Moderate or Major Adverse** magnitude and **Slight Adverse** significance.

Flood Risk

11.4.12 The FRA identifies changes in flood levels at discrete sensitive receptor locations throughout the Proposed Scheme extent. For the majority, the difference in water levels between existing and proposed conditions enables determination of the significance of impact to be **Negligible**.

11.4.13 Consideration has also been given to potential impacts identified in the vicinity of a sensitive receptor where the change in water level would result in a significance of impact greater than neutral (e.g. adjacent to the HML railway rather than at the location of the receptor itself). The proximity between the receptor and flood extent, as well as the relative height difference between the peak water level and receptor, has been taken into account when determining the significance of impact.

11.4.14 There is a material increase in flood risk in the vicinity of Drumochter Lodge due the proposed access track and landscape/ visual bund encroaching into the functional floodplain. The flood level adjacent to the upstream residential property is raised by approximately 800mm; therefore, as the sensitivity of the water feature MW7.19 has been determined as **Very High** and the magnitude of impact **Major Adverse**, the overall significance of impact is **Very Large Adverse**. However, as the property is 500mm above the peak water level it is not directly impacted by flooding in a 200-year event.

11.4.15 Flood levels in the River Truim are predicted to be raised by up to 30mm in 200yr event between ch. 3,800 and 4,000, adjacent to the HML railway; therefore, as the sensitivity of the Truim has been determined as **High** and the magnitude of impact **Minor Adverse**, the overall significance of impact is **Slight Adverse**. However, the HML railway is approximately 1.5m above the peak water level and therefore not directly impacted in a 200-year event.

11.4.16 Flood levels of the River Truim (MW8.1) are predicted to be raised by up to 10mm between ch. 6,300 and 6,400 adjacent to the HML railway; therefore, as the sensitivity of this watercourse has been determined as **High** and the magnitude of impact **Minor Adverse**, the overall significance of impact is **Slight Adverse**. However, the HML railway is approximately 3m above the peak water level and therefore not directly impacted in a 200-year event.

11.4.17 Flood levels in the River Truim are predicted to be raised by up to 30mm in 200yr event between ch. 7,150 to 7,450 adjacent to the HML railway; therefore, as the sensitivity of the Truim has been determined as **High** and the magnitude of impact Minor Adverse, the overall significance of impact is **Slight Adverse**. However, the HML railway is approximately 3.0m above the peak water level and therefore not directly impacted in a 200-year event.

11.4.18 The flood modelling results indicate two sections of the existing A9 (ch. 3,800 to 3,900 and 7,200 to 7,700) that are currently at risk of overtopping and flooding the road in a 200 year event. The Proposed Scheme removes this existing flood risk; therefore, as the watercourses within these sections are assigned **Very High** sensitivity for flood risk, and the magnitude of impact is deemed **Major Beneficial**, the overall significance of impact is **Very Large Beneficial**. Further details on all potential flood risk noted above are provided in the FRA within **Appendix 11.3** (**Volume 2**).

11.4.19 There is a potential risk of abrupt change in channel location of water feature MW7.23 (Allt Coire Bhotie), upstream of Hydro ID 64 due to the close proximity of the embankment cutting and upstream channel bank. This is most likely during a flood event that may result in subsequent flooding of the A9. As the sensitivity of the watercourse has been determined as **High** and the

magnitude of impact **Major Adverse**, the overall significance of impact is **Large Adverse**. Further details are provided in **Appendix 11.4** (**Volume 2**).

Hydromorphology

11.4.20 Proposed works in close proximity to the numerous watercourses crossed by the A9 in the study area have generally been found to have a **Neutral** significance of impact on the hydromorphology of the water environment. The scale of the works relative to the size of the watercourses has been determined as sufficient enough that they can 'absorb' the impact of the Proposed Scheme without adversely affecting the overall WFD status.

11.4.21 Four watercourses have been found to have a **Slight Adverse** significance of impact, one determined as **Slight Beneficial**, and one **Moderate Beneficial**. Further details are provided in **Appendix 11.4** (**Volume 2**).

Table 11- 9: Summary of potential impacts

Receptor	Chainage (ch.)	Detail of potential impact(s)	Sensitivity	Magnitude	Significance of Impact
Hydrology					
Catchment of Hydro ID 17/ W7.5	2,450	The total diversion of this watercourse north to Hydro ID 21 results in a change to its catchment of -100%. However, as the watercourse is not considered sensitive in terms of its hydrological importance, and the existing catchment is small (0.01km^2), the magnitude of change results only in a slight adverse significance of impact.	Low	Major Adverse	**Slight Adverse**
Catchment of Hydro ID 18/ W7.70	2,520 to 2,540	The total diversion of this watercourse north to Hydro ID 21 results in a change to its catchment of -100%. However, as the watercourse is not considered sensitive in terms of its hydrological importance, and the existing catchment is small (0.12km^2), the magnitude of change results only in a slight adverse significance of impact.	Low	Major Adverse	**Slight Adverse**
Catchment of Hydro ID 20/ W7.74	2,700 to 2,705	The total diversion of this watercourse north to Hydro ID 21 results in a change to its catchment of -100%. However, as the watercourse is not considered sensitive in terms of its hydrological importance, and the existing catchment is small (0.03km^2), the magnitude of change results only in a slight adverse significance of impact.	Low	Major Adverse	**Slight Adverse**
Catchment of Hydro ID 21/ W7.76	2,350 to 2,830	As this is a very small catchment (0.008km^2), increase in area from the diversions of Catchments 17, 18 and 20 from the south, results in an overall change to area of +2187%. However, as the watercourse is not considered sensitive in terms of its hydrological importance, the magnitude of change results only in a slight adverse significance of impact	Low	Major Adverse	**Slight Adverse**
Catchment of Hydro ID 40/ W7.109	4,960 to 4,695	The introduction of two additional culverts between existing Hydro IDs 40 and 42 have resulted in a change in catchment area of -69% draining to this point. However, as the watercourse is not considered sensitive in terms of its hydrological importance, the magnitude of change results only in a slight adverse significance of impact.	Low	Major Adverse	**Slight Adverse**
Catchment of Hydro ID 42/ W7.115	4,955 to 4,960	The introduction of two additional culverts between existing Hydro IDs 40 and 42 have resulted in a change in catchment area of -54% draining to this point. However, as the watercourse is not considered sensitive in terms of its hydrological importance, the magnitude of change results only in a slight adverse significance of impact.	Low	Major Adverse	**Slight Adverse**
Catchment of Hydro ID 43/ W7.9	5,500 to 6,150	The drainage layout of the Proposed Scheme diverts a proportion of the existing catchment draining to Hydro ID 43 south to Hydro ID 42. This results in a change in catchment area of -27%; however, as the watercourse is not considered sensitive in terms of hydrological importance, and the existing catchment is small (0.4km^2), the magnitude of change results only in a slight adverse significance of impact	Low	Moderate Adverse	**Slight Adverse**

Receptor	Chainage (ch.)	Detail of potential impact(s)	Sensitivity	Magnitude	Significance of Impact
Flood Risk					
HML	6,300 to 6,400	Flood levels in the River Truim are predicted to be raised by up to 10mm in 200yr event between ch. 6,300 and 6,400 adjacent to the HML railway	High	Minor Adverse	**Slight Adverse**
HML	3,800 to 4,000	Flood levels in the River Truim are predicted to be raised by up to 30mm in 200yr event between ch. 3,800 and 4,000 adjacent to the HML railway	High	Minor Adverse	**Slight Adverse**
Road (A9) (Hydro IDs 31 – 33)	3,800 to 3,900	The flood modelling results indicate locations of the A9 that are currently at risk of overtopping and flooding the road in a 200 year event which are removed in the Proposed Scheme scenario.	Very High	Major Beneficial	**Very Large Beneficial**
HML	7,150 to 7,450	Flood levels in the River Truim are predicted to be raised by up to 30mm in 200yr event between ch. 7,150 and 7,450 adjacent to the HML railway	High	Minor Adverse	**Slight Adverse**
Road (A9) (Hydro IDs 52 – 55)	7,200 to 7,700	The flood modelling results indicate locations of the A9 that are currently at risk of overtopping and flooding the road in a 200 year event which are removed in the Proposed Scheme scenario.	Very High	Major Beneficial	**Very Large Beneficial**
Drumochter Lodge	7,200 to 7,350	There is a material increase in flood risk in the vicinity of Drumochter Lodge due the proposed access track and landscape/ visual bund encroaching into the functional floodplain.	Very High	Major Adverse	**Very Large Adverse**
Allt Coire Bhotie (Hydro ID 64/ MW7.23)	9,300	Potential risk of channel abruptly changing location down cutting slope during flood event, and subsequently flooding of trunk road (A9)	High	Major Adverse	**Large Adverse**
Hydromorphology					
Allt Coire Mhic-sith (Hydro ID 2/ MW7.3)	0,400	Loss of natural bank- more uniform form and loss of sediment supply in drain outfall locations; Loss of natural bed- more uniform form, reduced range of substrate and reduced sediment supply in drain outfall locations; Fixing of channel position - harder for channel to adjust to changes in sediment supply and discharge (outfalls and bridge extension); Little change in flow (velocity and/ or discharge) conditions; Little change in continuity of sediment transfer; Little change in sediment dynamics	High	Minor Adverse	**Slight Adverse**
Allt Dubhaig (MW7.2)	0,400 to 2,850	Small change in flow (velocity and/or discharge) conditions due to works on tributaries Small improvement in continuity of sediment transfer Small improvement in sediment dynamics as more natural flow and sediment supply from tributaries	High	Moderate	**Moderate Beneficial**

Receptor	Chainage (ch.)	Detail of potential impact(s)	Sensitivity	Magnitude	Significance of Impact
Allt Fuar Bheann (Hydro ID 13/ MW7.6)	2,000	Loss of natural bank - more uniform form (culvert) and loss of sediment supply due to replacement of culvert and outfalls; Loss of natural bed - more uniform form, reduced range of substrate and reduced sediment supply due to culvert, realignment and outfall; Fixing of channel position - harder for channel to adjust to changes in sediment supply and discharge due to culvert and outfall; Improved flow (velocity and/ or discharge) conditions due to upsized culvert; Improved continuity of sediment transfer due to upsized culvert and natural substrate within culvert; Change in sediment dynamics - improved due to natural substrate within culvert and more natural flow	High	Minor Adverse	**Slight Adverse**
Unnamed tributary of Allt Fuar Bheann (Hydro ID 14/ W7.62)	2,100	Loss of natural bank - more uniform form (channel realignment and outfall) and loss of sediment supply due to longer, replacement culvert and additional culvert; Loss of natural bed - more uniform form, reduced range of substrate and reduced sediment supply due to culverts; Fixing of channel position - harder for channel to adjust to changes in sediment supply and discharge (outfall and culverts); Improved flow (velocity and/ or discharge) conditions due to catchpit removal; Improved continuity of sediment transfer due to catchpit removal; Improved sediment dynamics due to catchpit removal	Medium	Minor Beneficial	**Slight Beneficial**
Unnamed tributary of River Truim (Hydro ID 43/ W7.9)	6,150	Loss of natural bank - more uniform form (channel realignment, outfalls and culvert) and loss of sediment supply due to replacement of culvert; Loss of natural bed - more uniform form, reduced range of substrate and reduced sediment supply due to culvert and realignment; Fixing of channel position - harder for channel to adjust to changes in sediment supply and discharge due to culvert and outfalls; Improved flow (velocity and/ or discharge) conditions due to removal of catch pit and upsized culvert with natural bed; Improved continuity of sediment transfer due to natural substrate within culvert, upsized culvert and removal of catch pit; Change in sediment dynamics - Improved due to natural substrate within culvert and upsize of culvert and removal of catch pit	Low	Moderate Adverse	**Slight Adverse**
River Truim (MW8.1)	4,650 to 4,900; 6,135 to 6,275; 6,350 to 6,700; 6,660	Erosion protection (set back) totalling 550m: Loss of natural bank- more uniform form and loss of sediment supply due to outfalls. (Note that erosion protection is set back from the channel along the toe of embankments where it is required); Loss of natural bed- more uniform form, reduced range of substrate and reduced sediment supply due to outfalls; Fixing of channel position- harder for channel to adjust to changes in sediment supply and discharge due to set back erosion protection. (Erosion protection is set back from the channel banks to allow channel space to move while protecting the toe of the embankment from excessive erosion); Small change in flow (velocity and/or discharge) conditions due to outfalls; Small change in sediment dynamics due to outfalls	High	Minor	**Slight Adverse**

11.5 Mitigation

Standard, Embedded and Additional Mitigation

11.5.1 There are standard mitigation measures that are common to the A9 Dualling Programme. A number of the measures have been identified as being relevant to reduce the overall impacts of the Proposed Scheme on Road Drainage and the Water Environment, as listed in **Table 11- 10**. Additional reference should also be made to the individual risk assessments (**Appendices 11.2** to **11.4**) for further detail on appropriate mitigation measures.

11.5.2 As noted in **section 11.4**, embedded mitigation measures are project specific and are included in the design of the Proposed Scheme. For clarity, these are included in **Table 11- 11** where relevant to this chapter. Note the initial impact assessment has included consideration of these measures.

11.5.3 There is also project specific mitigation which includes additional measures which have been identified as part of this EIA process and which apply specifically to Road Drainage and the Water Environment affected by the Proposed Scheme. These are listed in

Table 11- 12.

11.5.4 The location of mitigation items (embedded and additional) is provided in **Drawings 11.19** to **11.25** (**Volume 3**).

11.5.5 The 'Timing of Measure' provided in **Tables 11-10 to 11-12** refers to the *implementation of the mitigation measure*. This could mean that implementation of the measure requires further work during contractor design and at construction, e.g. to work up detailed design and method statements to install an underpass, or an outfall and then implement during construction.

Table 11- 10: Standard Mitigation Commitments

Mitigation Item	Approximate Chainage/ Location	Timing of Measure	Description	Mitigation Purpose/ Objective	Specific Consultation or Approval Required
Standard A9 Mitigation					
SMC-W1	Throughout Proposed Scheme	Design, Pre-Construction & Construction	In relation to authorisations under CAR, the Contractor will be required to provide a detailed Construction Method Statement which will include proposed mitigation measures for specific activities including any requirements identified through the pre-CAR application consultation process.	To mitigate construction impacts on the water environment.	CAR applications require approval from SEPA
SMC-W2	Throughout Proposed Scheme	Pre-Construction & Construction	In relation to flood risk, the Contractor will implement the following mitigation measures during construction: • The Flood Response Plan (as part of the CEMP, refer to **Mitigation Item SMC-S1** in **Table 21-1** of **Chapter 21**) will set out the following mitigation measures to be implemented when working within the functional floodplain (defined here as the 0.5% AEP (200-year) flood extent): ➢ Routinely check the Met Office Weather Warnings and the SEPA Floodline alert service for potential storm events (or snow melt), flood alerts and warnings relevant to the area of the construction works. ➢ During periods of heavy rainfall or extended periods of wet weather (in the immediate locality or wider river catchment) river levels will be monitored using for example SEPA Water Level Data when available/ visual inspection of water features. The Contractor will assess any change from base flow condition and be familiar with the normal dry weather flow conditions for the water feature, and be familiar with the likely hydrological response of the water feature to heavy rainfall (in terms of time to peak, likely flood extents) and windows of opportunity to respond should river levels rise. ➢ Should flooding be predicted, works close or within the water features should be immediately withdrawn (if practicable) from high risk areas (defined as: within the channel or within the bankfull channel zone - usually the 50% (2-year) AEP flood extent). Works should retreat to above the 10% AEP (10-year) flood extent) with monitoring and alerts for further mobilisation outside the functional floodplain should river levels continue to rise. • Plant and materials will be stored in areas outside the functional floodplain where practicable, with the aim for temporary construction works to be resistant or resilient to flooding impacts, to minimise/ prevent movement or damage during potential flooding events. Where this is not possible, agreement will be required with the Environmental Clerk of Works (EnvCoW). • Stockpiling of material within the functional floodplain, if unavoidable, will be carefully controlled with limits to the extent of stockpiling within an area, to prevent compartmentalisation of the floodplain, and stockpiles will be located >10m from watercourse banks. • Temporary drainage systems will be implemented to alleviate localised surface water flood risk and prevent obstruction of existing surface runoff pathways. Where practicable, temporary haul routes will be located outside of the functional floodplain.	To reduce the risk of flooding impacts on construction works.	None required

Mitigation Item	Approximate Chainage/ Location	Timing of Measure	Description	Mitigation Purpose/ Objective	Specific Consultation or Approval Required
SMC-W3	Throughout Proposed Scheme	Pre-Construction Construction & Post-Construction / Operation	In relation to construction site runoff and sedimentation, the Contractor will adhere to GPPs/ PGGs (SEPA, 2006-2017) and other good practice guidance (Section 11.2), and implement appropriate measures which will include, but may not be limited to: • avoiding unnecessary stockpiling of materials and exposure of bare surfaces, limiting topsoil stripping to areas where bulk earthworks are immediately programmed • installation of temporary drainage systems/ SuDS systems (or equivalent) including pre-earthworks drainage • pre-earthworks drainage/ SuDS with appropriate outfalls to be in place prior to any earthworks activities • treatment facilities to be scheduled for construction early in the programme, 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 • the adoption of silt fences, check dams, settlement lagoons, soakaways and other sediment trap structures as appropriate • the maintenance and regrading of haulage route surfaces where issues are encountered with the breakdown of the existing surface and generation of fine sediment • provision of wheel washes at appropriate locations (in terms of proposed construction activities) and >10m from water features • protecting soil stockpiles using bunds, silt fencing and peripheral cut-off ditches, and location of stockpiles at distances >10m from water features • restoration of bare surfaces (seeding and planting) throughout the construction period as soon as possible after the work has been completed, or protecting exposed ground with geotextiles if to be left exposed	To implement appropriate controls for site runoff and sedimentation and reduce impacts on the water environment.	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. Where required, temporary discharge consents to be obtained from SEPA through the Water Environment (Controlled Activities) (Scotland) Regulations 2011 (as amended).
SMC-W4	Throughout Proposed Scheme	Pre-Construction & Construction	In relation to in-channel working, the Contractor will adhere to GPPs/ PPGS (SEPA, 2006-2017) and other good practice guidance (Section 11.2), and implement appropriate measures which will include, but may not be limited to: • undertaking in-channel works during low flow periods (i.e. when flows are at or below the mean average) as far as reasonably practicable to reduce the potential for sediment release and scour • no in-channel working during the salmonid spawning seasons unless permitted within any CAR licence • minimise the length of channel disturbed and size of working corridor, with the use of silt fences or bunds where appropriate to prevent sediment being washed into the water feature • limit the removal of vegetation from the riparian corridor, and retaining vegetated buffer zone wherever reasonably practicable • limit the amount of tracking adjacent to watercourses and avoid creation of new flow paths between exposed areas and new or existing channels.	To reduce impacts on the water environment during in-channel working.	Method statements for any in-channel working require approval by SEPA

Mitigation Item	Approximate Chainage/ Location	Timing of Measure	Description	Mitigation Purpose/ Objective	Specific Consultation or Approval Required
SMC-W5	Throughout Proposed Scheme	Construction	Where channel realignment is necessary, the Contractor will adhere to good practice guidance (Section 11.2) and implement appropriate measures which will include, but may not be limited to: • Once a new channel is constructed, the flow should, where practicable, be diverted from the existing channel to the new course under normal/ low flow conditions • diverting flow to a new channel should be timed to avoid forecast heavy rainfall events at the location and higher up in the catchment (the optimum time will be the spring and early summer months to allow vegetation establishment to help stabilise the new channel banks) • with offline realignments, the flow will be diverted with a steady release of water into the newly constructed realignment to avoid entrainment of fine sediment or erosion of the new channel • any proposed realignment works will be supervised by a suitably qualified fluvial geomorphologist.	To reduce impacts on the water environment where channel realignment is proposed.	Consultation with SEPA
SMC-W6	Throughout Proposed Scheme	Construction	In relation to refuelling and storage of fuels, the Contractor will adhere to GPPs/ PPGs (SEPA, 2006-2017) and other good practice guidance (Section 11.2), and implement appropriate measures which will include, but may not be limited to: • only designated trained and competent operatives will be authorised to refuel plant • refuelling will be undertaken at designated refuelling areas (e.g. on hardstanding, with spill kits available, and >10m from water features) where practicable • appropriate measures will be adopted to avoid spillages (refer to **Mitigation Item SMC-W7** below) • compliance with the Pollution Incident Control Plan (refer to **Mitigation Item SMC-S1** in **Chapter 21**).	To avoid spillages and reduce impacts on the water environment in relation to refuelling.	None required
SMC-W7	Throughout Proposed Scheme	Construction	In relation to oil/ fuel leaks and spillages, the Contractor will adhere to GPPs/ PPGs (SEPA, 2006-2017) and other good practice guidance (Section 11.2), and implement appropriate measures which will include, but may not be limited to: • stationary plant will be fitted with drip trays and emptied regularly • plant machinery will be regularly inspected for leaks with maintenance as required • spillage kits will be stored at key locations on-site and detailed within the Construction Environmental Management Plan (CEMP) (refer to Mitigation Item S1) • construction activities will comply with the Pollution Incident Control Plan (refer to **Mitigation Item SMC-S1** in **Chapter 21**).	To reduce impacts on the water environment in relation to oil/ fuel leaks and spillages.	None required
SMC-W8	Throughout Proposed Scheme	Construction	In relation to chemical storage, handling and reuse, the Contractor will adhere to GPPs/ PPGs (SEPA, 2006-2017) and other good practice guidance (Section 11.2), and implement appropriate measures which will include, but may not be limited to: • chemical, fuel and oil storage will be undertaken within a site compound, which will be located on stable ground at a low risk of flooding and >10m from any watercourse • chemical, fuel and oil stores will be locked and sited on an impervious base within a secured bund with 110% of the storage capacity • pesticides, including herbicides, will only be used if there are no alternative practicable measures, and will be used in accordance with CAR requirements, the manufacturer's instructions and application rates.	To reduce impacts on the water environment in relation to chemical storage, handling and reuse.	None required

Mitigation Item	Approximate Chainage/ Location	Timing of Measure	Description	Mitigation Purpose/ Objective	Specific Consultation or Approval Required
SMC-W9	Throughout Proposed Scheme	Construction	In relation to concrete, cement and grout, the Contractor will adhere to GPPs/ PPGs (SEPA, 2006-2017) and other good practice guidance (Section 11.2), and implement appropriate measures which will include, but may not be limited to: • concrete mixing and washing areas will: ➢ be located more than 10m from 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. • wash-water will not be discharged to the water environment and will be disposed of appropriately either to the foul sewer (with permission from Scottish Water), or through containment and disposal to an authorised site • where concrete pouring is required within a channel, a dry working area will be created • where concrete pouring is required within 10m of a water feature or over a water feature, appropriate protection will be put in place to prevent spills entering the channel (e.g. isolation of working area, protective sheeting) • quick setting products (cement, concrete and grout) will be used for structures that are in or near to watercourses.	To reduce impacts on the water environment in relation to concrete, cement and grout.	Permission required from Scottish Water. Consultation with SEPA.
SMC-W10	Site Compound/ Facilities	Construction	Sewage from site facilities will be disposed of appropriately either to a foul sewer (with the permission of Scottish Water) or via appropriate treatment and discharge agreed with SEPA in advance of construction and in accordance with 'PPG04 Treatment and Disposal of Sewage' (SEPA, 2003 – 2013).	To ensure sewage from site facilities is disposed of appropriately.	Permission required from Scottish Water for disposal to foul sewer or SEPA, in advance of construction, for appropriate treatment and discharge to a water course
SMC-W11	Throughout Proposed Scheme	Construction	In relation to service diversions and to avoid damage to existing services from excavations and ground penetration, including temporary severance of public and private water supplies through damage to infrastructure, the Contractor will: • locate and map all private or public water supply assets and other service infrastructure prior to construction • take measures to prevent damage to services and to avoid pollution during service diversions, excavations and ground works • provide a temporary alternative water supply (e.g. bottled or tankered) if services are to be disrupted or diverted by the works.	To mitigate service diversions and disruptions from excavations and ground penetration.	Consultation with SEPA

Mitigation Item	Approximate Chainage/ Location	Timing of Measure	Description	Mitigation Purpose/ Objective	Specific Consultation or Approval Required
SMC-W12	Throughout Proposed Scheme	Construction	For works within areas identified as potentially containing contaminated land and sediment the Contractor will reduce the risk of surface water pollution to an acceptably low level through: • further site investigation to determine the level of contamination prior to construction to beginning • the installation of temporary treatment facilities to enable removal of pollutants from surface waters • adoption of mitigation measures relating to contaminated land as outlined in **Chapter 10**.	To reduce risk of surface water pollution from areas identified as potentially contaminated land to an acceptably low level.	Details of any temporary treatment measures to be agreed with SEPA prior to commencement of construction
SMC-W13	Throughout Proposed Scheme	Design	In relation to bank reinforcement, design principles and mitigation measures will adhere to good practice (SEPA, 2008), which will include, but may not be limited to: • non-engineering solutions and green engineering (e.g. vegetation, geotextile matting) to be the preference during options appraisal • requirements for grey engineering to control/ prevent scour (e.g. rock armour, rip-rap, gabion baskets) to be minimised • post project appraisal to identify if there are issues that can be investigated and addressed at an early stage.	To reduce impacts of in-channel structures on the water environment.	Consultation with SEPA
SMC-W14	Throughout Proposed Scheme	Design	In relation to outfalls, specimen and detailed design will ensure compliance with good practice (e.g. CIRIA, 2015; The Highways Agency et al., 2004; SEPA, 2008), which will include, but may not be limited to: • directing each outfall downstream to minimise impacts to flow patterns • avoiding projecting the outfall into the watercourse channel • avoid installation of outfalls at locations of known historical channel migration • avoid positioning in flow convergence zones or where there is evidence of active bank erosion/ instability • directing an outfall away from the banks of a river to minimise any potential risk of erosion (particularly on the opposite bank) • minimising the size/ extent of the outfall headwall where possible to reduce the potential impact on the banks • post project appraisal to identify if there are issues that can be investigated and addressed at an early stage	To reduce impacts of outfalls on the water environment.	Consultation with SEPA

Mitigation Item	Approximate Chainage/ Location	Timing of Measure	Description	Mitigation Purpose/ Objective	Specific Consultation or Approval Required
SMC-W15	Throughout Proposed Scheme	Design	In relation to watercourse crossings, specimen and detailed design will ensure compliance with good practice (SEPA, 2010), which will include, but may not be limited to: • Detailed design will mitigate flood risk impacts through appropriate hydraulic design of culvert structures. Flood risk will be assessed against the 0.5%AEP (200-year) plus an allowance for climate change design flood event. Detailed design will mitigate any loss of existing floodplain storage volume where required by appropriate provision of compensatory storage. Where culvert extension is not practicable or presents adverse impact on the water environment, appropriately designed replacement culverts may be installed. • Detailed design will mitigate impacts on the water environment through appropriate design of culvert structures and watercourse modifications (e.g. realignments) with respect to fluvial geomorphology, and both riparian and aquatic ecology. • Detailed design of culverts and associated watercourse modifications will incorporate wherever practical: ➢ adherence to design standards and good practice guidance (Section 11.2) ➢ allowance for the appropriate conveyance of water and sediment for a range of flows (including at low flow conditions) ➢ maintenance of the existing channel gradient to avoid erosion at the head (upstream) or tail (downstream) end of a culvert ➢ avoidance of reduction of watercourse length through shortening of watercourse planform ➢ minimisation of culvert length ➢ close alignment of the culvert with the existing water feature ➢ depressing the invert of culverts to allow for formation of a more natural bed (embedment of the culvert invert to a depth of at least 0.15m to 0.3m) ➢ roughening of culvert inverts to help reduce water velocities. • Post project appraisal of watercourse crossings will be undertaken to identify if there are issues that can be investigated and addressed at an early stage.	To reduce impacts of culverts on the water environment.	Consultation with SEPA
SMC-W16	Throughout Proposed Scheme	Design & Construction	In relation to channel realignments, specimen and detailed design will ensure compliance with good practice (Section 11.2), which will include, but may not be limited to: • minimising the length of the realignment, with the existing gradient maintained where possible • design of the realignment in accordance with channel type and gradient • if required, low flow channels or other design features to reduce the potential for siltation and provide an opportunity to improve the geomorphology of the water feature • realignment designs will be led by a suitably qualified fluvial geomorphologist • where realignments result in an increase or decrease of channel gradient, the following principles will be applied: ➢ an increased gradient within the channel (resulting in higher stream energies) will require mitigation in the form of energy dissipation, which could include the creation of a step-pool sequence; boulder bed-checks; plunge pools at culvert outlets; and/ or; increased sinuosity ➢ a decrease in gradient within the channel will require mitigation in the form of the	To reduce impacts of channel realignment on the water environment.	Consultation with SEPA

Mitigation Item	Approximate Chainage/ Location	Timing of Measure	Description	Mitigation Purpose/ Objective	Specific Consultation or Approval Required
			construction of a low flow channel to minimise the impacts on locally varying flow conditions and reduce the risk of siltation of the channel • Post project appraisal to identify if there are issues that can be investigated and addressed at an early stage.		
SMC-W17	Throughout Proposed Scheme	Design & Construction	In relation to SuDS, the following mitigation measures will be implemented: • detailed design to adhere to design standards and good practice guidance (Section 11.2 of Chapter 11 Road Drainage and the Water Environment), including The SuDS Manual (CIRIA, 2015) and SuDS for Roads (SCOTS, 2010) • for each drainage run, a minimum of two levels of SuDS treatment within a 'treatment train' (see Table 1 of Appendix 11.2 for further details) to limit the volume of discharge and risk to water quality • management of vegetation within ponds and drains through grass cutting, pruning of any marginal or aquatic vegetation (as appropriate to the SuDS component) and removal of any nuisance plants, especially trees • SuDS retention ponds will be designed with an impermeable liner to maintain a body of standing water and provide treatment volume • inspect inlets, outlets, banksides, structures and pipework for any blockage and/ or structural damage and remediate where appropriate • regular inspection and removal of accumulated sediment, litter and debris from inlets, outlets, drains and ponds to avoid sub-optimal operation of SuDS • adherence to the maintenance plans specific to each SuDS component type as detailed within The SuDS Manual (CIRIA, 2015)	To reduce impacts of drainage discharges on the water environment.	Where required, authorisation for the road drainage discharge under CAR 2011 (as amended) would be obtained from SEPA

Table 11- 11: Embedded Mitigation

Mitigation Item	Approximate Chainage/ Location	Timing of Measure	Description	Mitigation Purpose/ Objective	Specific Consultation or Approval Required
Embedded Mitigation					
P07-W1	ch. -700/ west of A9 ch. 300/ west of A9 ch. 400/ west of A9 ch. 4,200/ west of A9 ch. 6,000/ west of A9 ch. 6,300/ west of A9 ch. 6,500/ west of A9 ch. 6,900/ west of A9 ch. 7,700/ west of A9 ch. 8,300/ west of A9 ch. 9,200/ west of A9	Design and Construction	**SuDS basin/ pond** Basins or ponds shall be sized to attenuate and store extreme flood events and restrict outflow to 'greenfield' runoff rates and provide long-term storage[1] Spillage containment features shall be included in SuDS facilities (emergency shut-off valve chambers on basin outlet); SuDS are to be lined to prevent adverse impacts to groundwater	Water quality treatment to road runoff as well as providing attenuation and storage to offset increased runoff area, reducing potentially adverse hydrological/ flood risk issues.	The Water Environment (Controlled Activities) (Scotland) Regulations (CAR) 2011 authorisation; SEPA consultation/ approval
P07-W2	ch. 100/ west of A9 ch. 2,000/ west of A9	Design and Construction	**SuDS basin/ pond** Enhanced treatment provided by inclusion of a micro-pool and/ or grassed channel (swale) to outfall	Providing additional/ enhanced treatment where required to meet water quality thresholds	SEPA consultation/ approval; CAR authorisation; CNPA consultation
P07-W3	ch. -900/ downstream of Hydro ID -2 ch. 200/ downstream of Hydro ID 1 ch. 210/ downstream of Hydro ID 1 ch. 400/ downstream of Hydro ID 2 ch. 2,050/ downstream of Hydro ID 13 ch. 4,250/ downstream of Hydro ID 36 ch. 6,150/ downstream of Hydro ID 43	Design and Construction	**SuDS outfall** Appropriate positioning of SuDS outfalls to minimise scour and erosion of channel bed and banks in line with SEPA guidance. Low velocity SuDS outfall and limited use of scour protection. SuDS outfalls to Major Watercourses to include grassed channels in the design – these will allow for	To ensure integrity of structure and natural channel is not compromised and SuDS remain operational.	CAR authorisation; Any outfalls to the River Truim (River Spey SAC) may need SNH approval; SEPA consultation/ approval

[1] 'Long term storage' i.e. to hold back any additional volume of runoff (the difference between the predicted development runoff volume and the estimated greenfield volume) until floodwaters have abated

Mitigation Item	Approximate Chainage/ Location	Timing of Measure	Description	Mitigation Purpose/ Objective	Specific Consultation or Approval Required
	ch. 6,400/ River Truim ch. 6,570/ River Truim ch. 7,000/ downstream of Hydro ID 51 ch. 7,850/ River Truim ch. 8,200/ downstream of Hydro ID 58 ch. 9,300/ downstream of Hydro ID 63/64 ch. 9,900/ on watercourse W8.1		river migration and erosion without affecting the effectiveness of the low velocity outfall		
P07-W4	ch. 3,020/ upstream of Hydro ID 23 ch. 3,040/ downstream of Hydro ID 23 ch. 3,200/ upstream of Hydro ID 25 ch. 3,300/ downstream of Hydro ID 25 ch. 4,000 to 4,200 west of A9 ch. 4,560 to 4,640 west of A9 ch. 4,770/ west of the A9 ch. 4,900/ west of the A9 ch. 4,950/ downstream of Hydro ID 42 ch. 6,400 to 6,460 west of A9 ch. 6,560 to 6,600 west of A9 ch. 6,950 to 7,000 west of A9 ch. 7,060 to 7,200 west of A9 ch. 7,900/ upstream of Hydro ID 57 ch. 9,150 to 9,270/ upstream of Hydro ID 63 ch. 9,300/ upstream of Hydro ID 64	Design and Construction	**Compensatory storage areas** Compensatory flood storage shall be sized to compensate for loss of 200yr functional floodplain	Included to offset any flood storage volume lost due to encroachments (mainline, access, SuDS) into the functional floodplain and avoid increased flood risk downstream	SEPA consultation/ approval
P07-W5	ch. 0,400/ Hydro ID 2 ch. 3,030/ Hydro ID 23 ch. 7,200/ Hydro ID 52 ch. 8,400/ Hydro ID 59 ch. 9,300/ Hydro ID 64	Design and Construction	**Structures** Bridge abutments set back from river banks to limit amount of erosion and scour protection required	Allow natural migration/ evolution of river morphology, allow natural channel migration and encourage sediment transfer through the catchment without compromising structural integrity; to reduce risk of erosion	CAR authorisation
P07-W6	ch. 3,000 to 3,020 at Hydro ID 23 ch. 3,770/ upstream of Hydro ID 31 ch. 6,980/ upstream of Hydro ID 51	Design and Construction	**Channel restoration** Restoration of natural bed shall be through the removal of concrete channels associated with existing structures	Restoration to more natural river morphology facilitating natural channel migration and encouraging sediment transfer through the catchment	CAR authorisation

Mitigation Item	Approximate Chainage/ Location	Timing of Measure	Description	Mitigation Purpose/ Objective	Specific Consultation or Approval Required
P07-W7	ch. 0,220/ Hydro ID 1 ch. 0,810/ Hydro ID 4 ch. 0,965/ Hydro ID 5 ch. 1,120/ Hydro ID 6 ch. 1,260/ Hydro ID 7 ch. 1,500/ Hydro ID 8 ch. 1,650/ Hydro ID 10 ch. 1,875/ Hydro ID 12 ch. 2,020/ Hydro ID 13 ch. 2,075/ Hydro ID 14 ch. 2,180/ Hydro ID 15 ch. 2,760/ Hydro ID 21 ch. 2,850/ Hydro ID 22 ch. 3,340/ Hydro ID 28 ch. 3,625/ Hydro ID 30 ch. 3,775/ Hydro ID 31 ch. 3,835/ Hydro ID 33 ch. 3,940/ Hydro ID 34 ch. 4,030/ Hydro ID 35 ch. 4,120/ Hydro ID 35a ch. 4,250/ Hydro ID 36 ch. 4,350/ Hydro ID 37 ch. 4,480/ Hydro ID 38 ch. 4,550/ Hydro ID 39 ch. 4,680/ Hydro ID 40 ch. 4,775/ Hydro ID 41a ch. 4,855/ Hydro ID 41b ch. 4,930/ Hydro ID 42 ch. 6,130/ Hydro ID 43 ch. 6,270/ Hydro ID 44 ch. 6,450/ Hydro ID 45 ch. 6,595/ Hydro ID 46 ch. 6,690/ Hydro ID 47 ch. 6,800/ Hydro ID 49 ch. 6,840/ Hydro ID 50 ch. 6,980/ Hydro ID 51	Design and Construction	**Culverts** Scour pools shall be provided upstream (at the inlet) of steep culverts crossing the A9 mainline (For oversizing of culverts to allow provision of mammal crossing and embedment of culvert invert for inclusion/ development of natural bed material see **Mitigation Items P07-E1**, **P07-E2**, and **P07-E3** in **Chapter 12**)	To dissipate energy and reduce risk of erosion in line with current standards	SEPA consultation/ approval; CAR authorisation

Mitigation Item	Approximate Chainage/ Location	Timing of Measure	Description	Mitigation Purpose/ Objective	Specific Consultation or Approval Required
P07-W8	ch. 0,220/ Hydro ID 1 AT ch. 0,610/ Hydro ID 3 AT ch. 0,790/ Hydro ID 4 AT ch. 2,020/ Hydro ID 13 AT ch. 2,075/ Hydro ID 14 AT ch. 3,340/ Hydro ID 27 AT ch. 3,445/ Hydro ID 28 AT ch. 3,860/ Hydro ID 33 AT ch. 4,030/ Hydro ID 35 AT ch. 6,810/ Hydro ID 49 AT ch. 7,625/ Hydro ID 56 AT BDL ch. 1,390/ Hydro ID 63 AT BDL ch. 1,420/ Hydro ID 63 AT BDL ch. 1,590/ Hydro ID 61 AT BDL ch. 1,645/ Hydro ID 61 AT	Design and Construction	**Culverts** Scour pools shall be provided upstream (at the inlet) of steep culverts crossing access tracks (AT)	To dissipate energy and reduce risk of erosion in line with current standards	SEPA consultation/ approval; CAR authorisation
P07-W9	ch. 9,850/ west of A9	Design and Construction	**Tank Sewer & Vortex separator** Use of proprietary SuDS where conventional treatment cannot be accommodated due to spatial constraints (in line with the SuDS Manual)	Providing additional/ enhanced treatment where required to meet water quality thresholds.	SEPA consultation/ approval; CAR authorisation
P07-W10	Throughout Proposed Scheme extent – all un-kerbed roads	Design and Construction	All un-kerbed roads to be provided with 'over-edge' drainage via filter drains (or conveyance swales)	Providing source control and first treatment stage	N/A
P07-W11	Access track east of A9 (between Hydro IDs 55 and 71)	Design and Construction	Dispersal trenches on the downstream side of Beauly to Denny Power Line access track	To maintain surface water supply to potentially sensitive habitats	SNH consultation; CNPA consultation

Table 11- 12: Project-Specific Mitigation

Mitigation Item	Approximate Chainage/ Location	Timing of Measure	Description	Mitigation Purpose/ Objective	Specific Consultation or Approval Required
Project-Specific Mitigation					
P07-W12	ch. 0,400/ Hydro ID 2 ch. 3,030/ Hydro ID 23 ch. 7,200/ Hydro ID 52 ch. 8,400/ Hydro ID 59 ch. 9,300/ Hydro ID 64	Design and Construction	**Structures** The Contractor shall evaluate the potential of setting back abutments further from river banks to limit amount of erosion and scour protection required by carrying out detailed environmental and engineering assessments during detailed design	Allow natural migration/ evolution of river morphology, allow natural channel migration and encourage sediment transfer through the catchment without compromising structural integrity; to reduce risk of erosion	CAR authorisation
P07-W13	ch. 0,480/ upstream of Hydro ID 2 ch. 1,500/ upstream of Hydro ID 8 ch. 3,030/ upstream of Hydro ID 23 ch. 4,250/ downstream of Hydro ID 35 ch. 4,550/ downstream of Hydro ID 39 ch. 4,700/ downstream of Hydro ID 40 ch. 4,780/ downstream of Hydro ID 40 ch. 4,850/ right bank of River Truim ch. 4,950/ right bank of River Truim ch. 6,300/ downstream of Hydro ID 44 ch. 6,460/ downstream of Hydro ID 45 ch. 6,600/ downstream of Hydro ID 46 ch. 6,700/ downstream of Hydro ID 47 ch. 6,860/ downstream of Hydro ID 50 ch. 7,000/ right bank of River Truim ch. 7,300/ downstream of Hydro ID 52 ch. 7,500/ right bank of River Truim ch. 8,400/ upstream of Hydro ID 59 ch. 9,100/ downstream of Hydro ID 62 ch. 9,300/ downstream of Hydro ID 64 ch. 9,370/ upstream of Hydro ID 64	Design and Construction	**Drainage channel** Outfall at risk of erosion, therefore, design outfall using green engineering to allow for channel adjustment in receiver channel (change in bed and bank position) Low velocity outfall	Reduce potential scour/ erosion around drainage outfalls due to alterations in fluvial processes. Ensure integrity of structure is not compromised and remain operational.	CAR authorisation; CNPA consultation
P07-W14	ch. 3,000/ downstream of Hydro ID 23	Design and Construction	**Channel restoration** Improve/ remove step in bed at NMU crossing and introduce step-pool morphology	Improve channel morphology to a more natural condition and remove existing morphological and aquatic ecological barrier	CAR authorisation

Mitigation Item	Approximate Chainage/ Location	Timing of Measure	Description	Mitigation Purpose/ Objective	Specific Consultation or Approval Required
P07-W15	ch. 9,350/ upstream of Hydro ID 64	Design and Construction	**Watercourse diversion** Detailed design to investigate and consider possibility of alternative upstream channel alignment. Suggest slope is steepened and/ or channel realigned farther from the top of cutting and fix bank position	Remove the high risk of water flowing down cutting onto road when out of bank flow occurs; Remove erosion risk on the outside bank of channel 64 cutting into the road embankment	CAR authorisation
P07-W16	ch. 9,270 to 9,400 downstream of Hydro IDs 63 and 64	Design and Construction	**Watercourse diversion** Reprofile banks to improve channel stability and reduce excessive incision	Improve channel stability and reduce excessive incision; Will protect SuDS pond and provide ecological improvements	CAR authorisation
P07-W17	ch. 200/ downstream of Hydro ID 1 ch. 1,150/ downstream of Hydro ID 6 ch. 1,700/ downstream of Hydro ID 10 ch. 3,000/ downstream of Hydro ID 23 ch. 4,500/ downstream of Hydro ID 38 ch. 6,890/ downstream of Hydro ID 50 ch. 8,700/ downstream of Hydro ID 61	Design and Construction	**Watercourse diversions** Back fill valley (redundant channel) after watercourse has been diverted into the new channel	Ensure high flows do not overtop into old channel causing erosion/ avulsion/ scour	CAR authorisation
P07-W18	ch. 3,000 between NMU and HML ch. 6,100 right bank of Truim between HML and A9 ch. 6,200 right bank of Truim to the west of A9 ch. 6,300 right bank of Truim to the west of A9 ch. 6,400 right bank of Truim to the west of A9 ch. 6,800 around Balsporran SuDS 069 ch. 9,300 left bank of Allt Coire Bhotie west of A9 ch. 9,300 right bank of Allt Coire Bhotie west of A9	Design, Construction, and Post-construction/ Operation	**Riparian planting** Awareness of flood risk should be taken into account when selecting species for riparian planting in the circa 5m buffer along watercourse channel banks	Avoid potential blockage of downstream crossings from large vegetation species (i.e. fallen trees and branches)	CNPA consultation

Mitigation Item	Approximate Chainage/ Location	Timing of Measure	Description	Mitigation Purpose/ Objective	Specific Consultation or Approval Required
P07-W19	ch. 400/ downstream of Hydro ID 2 ch. 1,300/ downstream of Hydro ID 7 ch. 1,550/ downstream of Hydro ID 8 ch. 1,900/ downstream of Hydro ID 12 ch. 2,050/ downstream of Hydro ID 13 ch. 2,100/ downstream of Hydro ID 14 ch. 9,300/ downstream of Hydro ID 63 & 64	Design and Construction	**Watercourse diversions** Resection the channel (alter its bed slope and morphology) to create more stable channel	Improve stability of channels and protect road from erosion; Reduce excessive sediment supply	CAR authorisation
P07-W20	ch. 0,400/ Hydro ID 2 ch. 3,030/ Hydro ID 23 ch. 8,400/ Hydro ID 59	Design and Construction	**Channel Restoration** All watercourses crossing the A9 under these structures require step-pool morphology upstream and downstream of the crossing, as well as through the structure itself. Removal and/ or reprofiling of existing engineered banks should also be incorporated at detailed design stage	To dissipate energy and reduce risk of erosion in line with current standards Ensure the channel does not negatively impact sediment continuity through excessive erosion, either in the vicinity of the scheme, or outside the scheme boundary	CAR authorisation
P07-W21	Access track approx. ch. 3,925 – 4,000	Design and Construction	**Access Track** Contractor should investigate potential of lowering access track to further minimise floodplain encroachment on the basis of more detailed GI information.	Reduce volume lost in floodplain and lessen area of compensatory storage required	SEPA consultation/ approval
P07-W22	ch. 7,400 to 7,450	Design and Construction	**Flood relief culverts** Relief culverts (or equivalent measure) to be incorporated into the mainline and visual screening berm design in the vicinity of Drumochter Lodge. There may be a residual loss of floodplain volume, however, with the compensatory storage area already proposed a material increase in flood risk elsewhere is not predicted Compensatory storage area downstream of Hydro ID 113 (ch. 7,060 to 7,200) west of A9 should be designed to account for the effect of the flood relief culverts on displaced floodplain volume upstream of bund	To mitigate increased flood risk identified in the FRA as a result of the Landscape/ Visual bund introduced to the east of the trunk road	SEPA consultation/ approval
P07-W23	ch. 0,400/ Hydro ID 2 ch. 3,030/ Hydro ID 23 ch. 7,200/ Hydro ID 52 ch. 8,400/ Hydro ID 59 ch. 9,300/ Hydro ID 64	Design and Construction	**Structures** Low flow channels designed to take the 1:2 year flow to maintain minimum depth of water	Ensure low flows under bridges for ecological permeability	CAR authorisation

Mitigation Item	Approximate Chainage/ Location	Timing of Measure	Description	Mitigation Purpose/ Objective	Specific Consultation or Approval Required
P07-W24	ch. 0,400/ at Hydro ID 2 ch. 3,000 to 3,020 at Hydro ID 23 ch. 3,770/ upstream of Hydro ID 31	Design and Construction	**Channel restoration** Restoration of natural bed shall be through the removal of concrete channels associated with existing structures	Restoration to more natural river morphology facilitating natural channel migration and encouraging sediment transfer through the catchment	CAR authorisation
P07-W25	ch. 7,900/ Hydro ID 57 ch. 9,275/ Hydro ID 63 ch. 9,300/ Hydro ID 64	Design and Construction	**Crossings** Retain existing capacity if possible (departure from design standard of conveying 200yr flow) to mitigate impacts identified in the FRA	Utilise existing upstream storage by throttling flow and protecting downstream receptors	CAR authorisation; SEPA consultation/ approval
P07-W26	Multiple discrete locations through the Project 7 Proposed Scheme extent	Design and Construction	**Watercourse Diversions** Ensure that any imported bed material for all diversions is of the same size and geology as the existing and re-use existing bed material where possible and suitable	Encourage re-establishment of natural fluvial form and processes	CAR authorisation; SEPA consultation/ approval
P07-W27	Balsporran carpark	Design and Construction	Use of a cellular system filled with single sized stone and a filter drain which will take the filtered runoff through a further level of treatment before discharging into the Truim	System allows runoff to filter through the surface a pea gravel layer sits below that providing an additional level of treatment.	CAR authorisation; CNPA consultation
P07-W28	ch. 6,200 at access track	Design and Construction	**Encroachment** Contractor should evaluate potential of removing scheme encroachment into functional floodplain of River Truim by carrying out detailed environmental and engineering assessments during detailed design	Offset any flood storage volume lost and avoid increased flood risk downstream	SEPA consultation/ approval
P07-W29	ch. 7,150 to 7,450/ west of A9	Design and Construction	**Access tracks** Contractor should evaluate potential to construct access track in such a way it avoids overland flows and flood route by carrying out detailed environmental and engineering assessments during detailed design	Access track in overland flood route adjacent to Drumochter Lodge	SEPA consultation/ approval
P07-W30	All watercourse diversions throughout the Project 7 Proposed Scheme extent	Design and Construction	**Watercourse Diversions** Create channel with diverse bed and bank morphology suitable for bed slope and evolution into stable channels. Ensure natural channel dimensions are maintained. All watercourse diversions are to have a “low flow” channel, design to accommodation the 1:2 year flows on a site by site basis	To maintain a minimal depth of flow and to allow for natural process and stability of new channels	CAR authorisation
P07-W31	All culverts throughout the Project 7 Proposed Scheme extent	Design and Construction	**Culverts** All culverts are to have a “low flow” channel, design to accommodation the 1:2 year flow on a site by site basis	To maintain a minimal depth of flow and to allow for natural process and stability through culvert	SEPA consultation/ approval; CAR authorisation

Mitigation Item	Approximate Chainage/ Location	Timing of Measure	Description	Mitigation Purpose/ Objective	Specific Consultation or Approval Required
P07-W32	All watercourse channels throughout the Project 7 Proposed Scheme extent	Design and Construction	**Channel material** All material that is to be placed within the channel (realignment, structure, culvert) should be specified (i.e. grain size and composition) and clearly justified. The calibre and quantity of material should be determined on a site by site basis and this should take into account changes in the energy regime within the river.	To allow the ongoing downstream transfer of sediment	CAR authorisation
P07-W33	All culverts throughout the Project 7 Proposed Scheme extent	Design and Construction	**Culverts** All culverts are to have a scour pool at the outfall	Dissipate energy and reduce risk of scour to structures	SEPA consultation/ approval; CAR authorisation
P07-W34	All culverts throughout the Project 7 Proposed Scheme extent	Design and Construction	**Culverts** Identify and design energy dissipation in culverts on a site by site basis. This could take the form of step-pool like structures, which will also aid in retention of bed material.	Dissipate energy and reduce risk of scour to structures. Aid with sediment retention in culvert.	SEPA consultation/ approval; CAR authorisation

11.6 Residual Impacts

11.6.1 Following implementation of the range of mitigation measures outlined in **section 11.5**, potential impacts on the water environment will be avoided/ prevented, reduced or offset.

11.6.2 The vast majority of residual impacts would be reduced to **Neutral** significance, due to the adoption of appropriate additional mitigation measures. For example, a **Neutral** significance for flood risk has been achieved with the provision of compensatory storage areas (based on a level-for-level volume-slices approach) designed to offset the loss of functional floodplain from encroachment of mainline, access tracks and SuDS.

11.6.3 The remaining residual impacts that would not be of **Neutral** significance (beneficial and adverse) are presented in **Table 11- 13**.

11.6.4 Recommendations for routine and periodic operational-phase monitoring are also reported where relevant in the appropriate appendices. The purpose of monitoring (in line with EIA Directive) is to ensure the effectiveness of mitigation measures on any significant (adverse) impacts on the environment resulting from the construction and operation of the Proposed Scheme.

11.6.5 On-going inspections and maintenance requirements will also ensure optimal performance of embedded and proposed mitigation within the Proposed Scheme to offset any identified potential impacts on the water environment. Beyond the initial contractor maintenance period (typically up to five years post-completion), regular inspection and maintenance schedules (including drainage networks and SuDS features) will be transferred to the relevant Trunk Road Operating Company and will be permanently maintained via Operating Company contracts.

Table 11- 13: Predicted residual impacts on the water environment

Name/ Water Feature Ref.	Sensitivity	Significance of Impact	Mitigation	Summary of Residual Impacts	Magnitude of Residual Impact	Significance of Residual Impact
Multiple watercourses throughout the Proposed Scheme extent	Low to High	Slight Beneficial	Provision of SuDS for treatment of routine road runoff and spillage containment for and protection of surface and groundwater runoff	SuDS will reduce contamination and pollution risk commonly associated with road runoff and accidental spillage and provide a beneficial impact on the water environment comparative to exiting conditions as the current A9 has limited or no road drainage treatment	Minor Beneficial	**Slight Beneficial**
Multiple watercourses throughout the Proposed Scheme extent	Low to High	Slight Beneficial	The inclusion of SuDS in the Proposed Scheme design provides attenuation to greenfield runoff rates across the Project extent	Despite the dualled carriageway increasing potential surface runoff, the absence of existing attenuation means the Proposed Scheme will result in an overall improvement on the water environment resulting in a residual Slight Beneficial impact.	Minor Beneficial	**Slight Beneficial**
Road (A9) (ch. 3,800 to 3,900) (ch. 7,200 to 7,700)	Very High	Very Large Beneficial	Upsizing of culverts crossing the A9 to increase conveyance capacity	The design of the Proposed Scheme provides a beneficial impact to the water environment in terms of flood risk at these locations as it results in a decrease (removal) in water levels at critical infrastructure	Major Beneficial	**Very Large Beneficial**
River Truim (MW8.1)	High	Slight Adverse	None	Erosion protection to the embankment toe has been set back from the channel allowing space for the channel to migrate without causing excessive erosion and damage to infrastructure. However, due to the total length of long-term channel fixing (550m) an adverse impact remains	High	**Slight Adverse**
Allt Coire Mhic-sith (Hydro ID 2/ MW7.3)	High	Slight Adverse	Restoration to more natural river morphology by ensuring varied bed and bank profiles for realignment channels (See **Annex 11.4.5, Appendix 11.4** for more details), setting back of structures from river banks; erosion and scour protection for bridge abutments and drainage/ SuDS outlets; and low flow channel to maintain minimum flows	Implementation of additional mitigation Restoration to more natural river morphology facilitating natural channel migration and encouraging sediment transfer through the catchment resulting in beneficial impacts on the hydromorphology of the water environment	Minor Beneficial	**Slight Beneficial**
Unnamed watercourse (MW7.5/ Hydro ID 12	Medium	Slight Beneficial			Minor Beneficial	**Slight Beneficial**

Name/ Water Feature Ref.	Sensitivity	Significance of Impact	Mitigation	Summary of Residual Impacts	Magnitude of Residual Impact	Significance of Residual Impact
Allt Fuar Bheann (Hydro ID 13/ MW7.6)	High	Slight Adverse			Minor Beneficial	**Slight Beneficial**
Unnamed tributary of Allt Fuar Bheann (Hydro ID 14/ W7.62)	Medium	Slight Beneficial			Minor Beneficial	**Slight Beneficial**
Unnamed tributary of River Truim (Hydro ID 43/ W7.9)	Low	Slight Adverse			Minor Beneficial	**Slight Beneficial**
Allt Dubhaig (MW7.2)	High	Moderate Beneficial	None	The watercourse will benefit from improved continuity of sediment through the catchment, improved sediment dynamics and more natural flows from tributaries as a result of Proposed Scheme works at upstream crossings.	Moderate Beneficial	**Moderate Beneficial**
Drumochter Lodge (MW7.19/ Hydro ID 52)	Very High	Very Large Adverse	Hydraulic overflow – flood relief culverts (or similar) to provide overspill at 200 year flood level and afford protection to residential property (sensitive receptor)	Provision of flood relief culverts will ensure that the residential property at Drumochter Lodge is protected in the event of an extreme flood.	Negligible*	**Neutral***
					**As a material increase in flood levels between existing and proposed conditions is still noted, the significance of residual impact will still be considered Very Large Adverse using the assessment criteria outlined in Section 11.2.* *However, the proposed flood relief culverts will ensure peak water levels cannot exceed floor levels of the property.* *Therefore, an overall Neutral significance of residual impact at this receptor is determined.*	

11.7 Summary of Combined Impacts

11.7.1 Cumulative impacts are provided in this section here in order to demonstrate that there are no adverse impacts to the water environment as per DMRB HD45/09 and SPP and SEPA guidance. Cumulative impacts are also considered relevant to WFD status (i.e. cumulative impact can downgrade classification of a water body) hence CAR requires wider consideration of multiple activities on a single project or multiple projects on a single water body.

Water Quality

11.7.1 The HAWRAT assessment requires that any two outfalls situated within the same reach are subject to a cumulative assessment. In line with DMRB HD45/09, a precautionary approach has been adopted when aggregating outfalls for the cumulative impact assessment. Soluble pollutants have been assessed where numerous outfalls are within a 1km reach[2] of a receiving watercourse. For sediment bound pollutants, outfalls within a 100m reach have been aggregated. No cumulative impacts were found to fail the HAWRAT assessment after implementation of mitigation, i.e. that which has been incorporated into the Proposed Scheme design. Details of the assessment are provided in **Appendix 11.2**.

Hydrology and Flood Risk

11.7.2 Existing conditions and the Proposed Scheme have been hydraulically modelled. The results of the Enhanced 2D models do not indicate a material change in flood risk passed downstream. The full-length model of the River Truim predicts that cumulative impacts on flood risk throughout the Proposed Scheme study area may culminate in an increase in the peak flow passed to the River Truim downstream of approximately 1% for the 200yr design event (approximately 3mm in flood levels at the northernmost extent of the project, post-development). The model does not consider mitigation options. Details of the assessment are provided in **Appendix 11.3.**

Hydromorphology

11.7.3 There will be multiple small changes to sediment transfer, discharge and velocity within the tributaries that flow into the River Garry, Allt Dubhaig and the River Truim. These have the potential to have a positive impact the form and processes of the larger downstream watercourses and the wider catchment over long timescales by returning flows and sediment supply to more natural pre A9 conditions.

11.7.4 Many of the proposed works (increasing culvert capacity, providing a natural bed within culverts and under bridges and removing catchpits) will increase discharge capacity and potential volume of sediment conveyed from the tributaries to the downstream watercourses, creating more

[2] For the purpose of this report, a reach is defined as a length of watercourse between two confluences.

natural conditions by returning the systems to something closer to those that were present before the A9 was originally constructed. This will have a **Slight Beneficial** cumulative impact on the hydromorphology of the tributaries and the downstream watercourses. Details of the assessment are provided in **Appendix 11.4.**

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