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 9 – Crubenmore to Kincraig (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 assessment approach, describing baseline conditions, design development and embedded mitigation. Key issues for assessment and potential impacts are identified, mitigation to reduce or negate any potential impacts and any remaining 'residual' impacts are highlighted.

11.1.3 The content 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 TD37/93). 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
- 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 natural 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 are 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: Water Quality (surface and groundwater), Hydromorphology, and Hydrology and Flood Risk.

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.

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
- Pollution Prevention and Control (Scotland) Regulations 2012 (PPC 2012)

11.2.4 Further explanation and relevance of national/ local planning policies affecting hydrology/ drainage 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, HD33/16: *'Design of highway drainage systems'*
- *'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, v5.2, 2014 and Supporting Guidance (WAT-SG-53) *'Environmental Standards for Discharges to Surface Waters'* v6.1, SEPA, 2018
- *'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'*v10, SEPA, 2018

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'*, River Restoration Centre (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-75: '*Sector Specific Guidance: Construction Sites'*, SEPA, 2018
- 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 CIRIA (C648), 2006

Study area

11.2.6 The Proposed Scheme assessed in this report is approximately 16km between Crubenmore and Kincraig, it runs parallel to two major watercourses – the River Truim between chainage (ch.) 40,000 to 41,000, and the River Spey (to the east between ch. 41,000 to 50,150 and to the west between ch. 50,200 to 56,700) as shown in **Drawings 5.1 to 5.12** of **Volume 3** of this report.

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 Truim and the River Spey act as hydrological barriers and it is very 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 scheme topographical survey, have been delineated by a 500m offset on the upstream side of the existing A9 corridor and the far side bank (looking downstream) of the River Truim and the River Spey. 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 5.1** to **5.12** 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 **11.12** (**Volume 3**) of this report.

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 11.13** (**Volume 3**) of this report.

11.2.10 In addition to numerous waterbodies and functional floodplains (in particular the River Spey) that constrain Project 9, there are a number of other ecological and cultural heritage constraints (discussed in greater detail in **Chapters 12** and **15,** respectively) identified within the Proposed Scheme extent. These include:

- River Spey – Insh Marshes Ramsar site
- River Spey – Insh Marshes Special Protection Area (SPA)
- Insh Marshes Special Area of Conservation (SAC)
- River Spey SAC
- River Spey – Insh Marshes Site of Special Scientific Interest (SSSI)
- River Spey SSSI
- Insh Marshes National Nature Reserve (NNR)

- Cairngorms National Park (CNP)
- Ancient Woodland
- Ruthven Barracks Scheduled Monument and A Listed Building
- Raitts Cave Souterrain, Lynchat – Scheduled Monument
- Complex of B and C Listed Buildings at Balavil and Meadowside

11.2.11 Several significant engineering constraints are also located within close proximity to the project extents, and include:

- Highland Mainline (HML) railway, running to the west of the A9 between Crubenmore and Kingussie and, after crossing beneath the A9, continuing to the east of the road towards Kincraig
- National Cycle Network route 7 (NCN7), which runs to the west of the A9 before crossing to the east at Kingussie
- The B9152 local road which is located to the east of the mainline north of Kingussie
- The Highland Wildlife Park at the northernmost section of the scheme
- Private properties and estates

11.2.12 The proposed positioning and design of engineering activities associated with the water environment (e.g. watercourse diversions, compensatory storage areas) takes cognisance of these wide ranging constraints. This approach aims to minimise the likelihood of adversely impacting on the numerous receptors throughout Project 9.

Baseline data sources

Desk-based Study

11.2.13 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)
- 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); and FEH Web Services (2017)
- 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 SNH)
- Coarse sediment dynamic information (provided by SEPA)
- Morphological pressure information (provided by SEPA)
- Flow gauge data (provided by SEPA)
- SEPA online interactive Drinking Water Protection Areas (DWPA) mapping

11.2.14 A range of published reports was used to inform the assessment of baseline conditions of the River Spey (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

11.2.15 A scheme wide photogrammetry survey, carried out by Blom (2014) for Transport Scotland, enabled identification of water features and crossing locations. This information was supplemented by site walkovers undertaken largely 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

11.2.16 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.

Water Features Survey

11.2.17 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.

11.2.18 Relevant baseline information on individual watercourses, drains, ponds, wetlands, springs, abstractions, discharges, and built structures has been recorded in a Water Features Schedule in **Appendix 11.1 (Volume 2),** and accompanying Water Features Plan included in **Drawings 11.1** to **11.12 (Volume 3)**. This information and the environmental parameters of Water Quality, Hydromorphology, 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.

11.2.19 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

11.2.20 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 assigned a 'Hydro ID' and are shown on **Drawings 11.1** to **11.12 (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.

11.2.21 The water features schedule also identifies standing waters (lochs, ponds, reservoirs), water supply abstractions found within the study area, and licenced discharges (CAR approved).

Scoping Out

11.2.22 An initial desk-based study screening assessment was carried out to determine which of the waterbodies identified by the topographical survey were unlikely to be impacted by the Proposed Scheme. These were generally waterbodies outwith the 'DMRB Stage 3 Detailed Study' (see **section 11.2 'Study area'**) or those waterbodies with an interrupted source-pathway-receptor linkage to the Proposed Scheme (e.g. located on the opposite side of a local road or the Highland Mainline railway). This reduced the number of potentially affected waterbodies within the study area from over 140 to approximately 40.

11.2.23 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 etc. attributes (and will be replaced by new drainage), they are not assessed further i.e. not subject to a pre-and post-mitigation assessment.

Procedure for assessing impacts

11.2.24 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.

11.2.25 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

11.2.26 For the purposes of the assessment the spatial extent considered when assigning magnitude and significance of impact relies on expert 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

11.2.27 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.

11.2.28 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 10.9µg/l for zinc.

11.2.29 The DMRB method for assessing potential impacts of routine runoff to groundwater applies when there is a potential direct discharge to groundwater; the methodology is based on a Source-Pathway-Receptor (S-P-R) protocol.

11.2.30 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

11.2.31 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).

11.2.32 Understanding of baseline flood conditions has been enhanced using information derived from the development of a 2D flood model for the River Truim and River Spey 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 and THC. Further details of the hydrological and hydraulic modelling approach are provided in the Flood Risk Assessment (FRA) within **Appendix 11.3 (Volume 2).**

Hydromorphology

11.2.33 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), 2017
- *'Review of Impact Assessment Tool and Post Project Monitoring Guideline, Report to SEPA'* by Haycocks Associates (WAT-SG-30), 2005
- *'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

11.2.34 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

11.2.35 Specific one-to-one consultation relating to the water environment has been undertaken with SEPA and The Highland Council (THC). The consultation focussed on topics such as the River Spey crossing options, hydrology and hydraulic modelling approach, and flood mitigation i.e. provision of compensatory flood storage areas.

11.2.36 Further input has been provided throughout the design process via consultation forums and an Environmental Steering Group (ESG) (which includes members of SEPA, SNH, 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**).

11.2.37 Consultation with additional relevant stakeholders (non-ESG members) including Spey Fisheries Board (SFB), the Royal Society for the Protection of Birds (RSPB) 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

11.2.38 All watercourse crossings have been designed and assessed individually, as well as cumulatively, to identify mitigation requirements for any potentially adverse impacts.

11.2.39 **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.

11.2.40 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.

11.2.41 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 storage required to offset loss of functional floodplain.

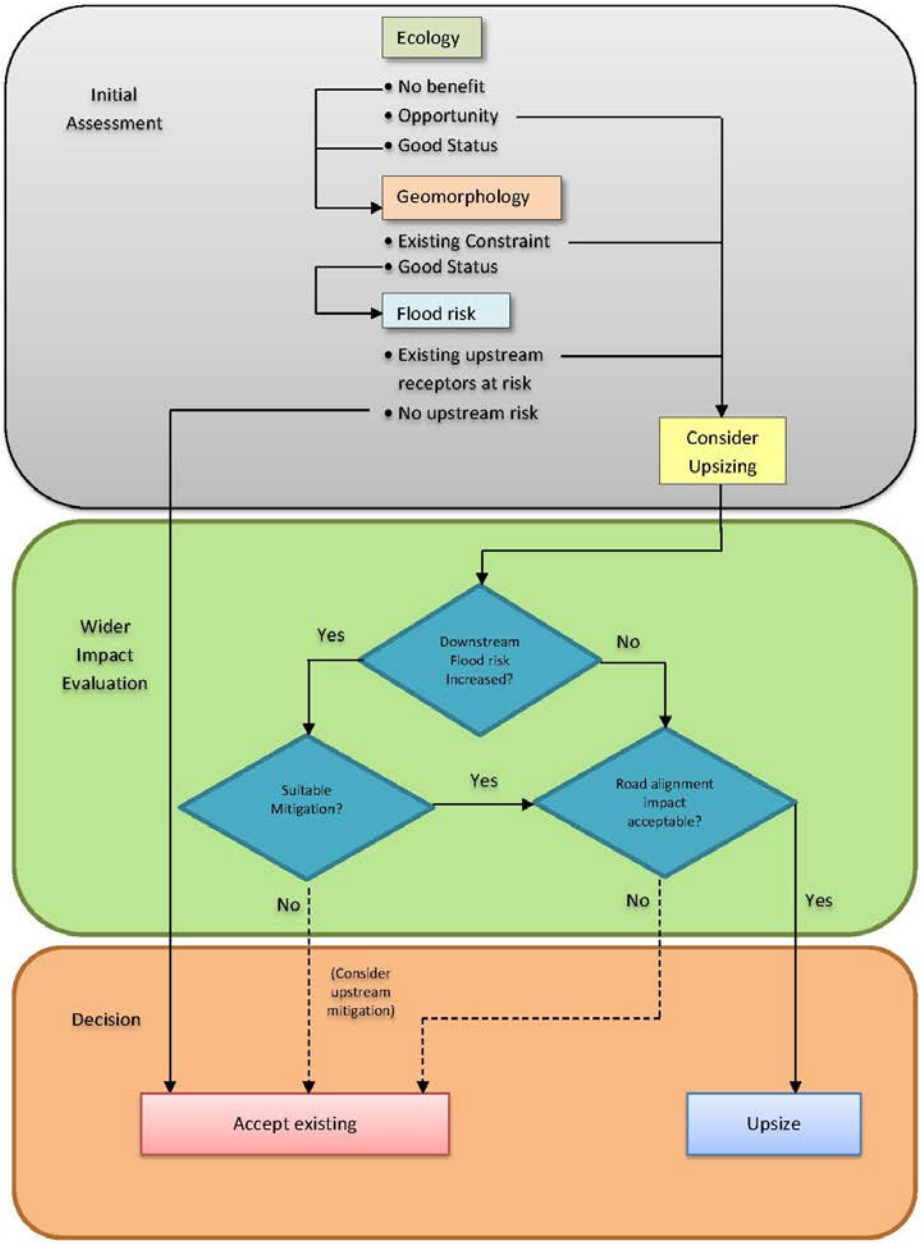

Figure 11- 1: Flow chart of process for selection and impact evaluation of replacement watercourse crossings

Assigning values to water feature sensitivity, attributes and impacts

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

11.2.43 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.

11.2.44 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 significance of impact matrix 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. Special Area of Conservation (SAC), Special Protection Area (SPA), Ramsar site), and/or no existing pressures to biodiversity. – **Dilution and Removal of Waste Products**: A high number of licenced discharges/ high daily volume of discharges to or within 50m of water feature (with potential hydraulic connectivity to the water feature) under CAR relative to flow **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) in a 1 in 200-year event (0.5% AEP).

Sensitivity	Typical Criteria/ Indicator of Value
	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.
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. – **Dilution and Removal of Waste Products:** Some existing licenced discharges/ moderate daily volume of discharges to or within 50m of water feature under CAR relative to flow **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 in a 1 in 200-year event (0.5% AEP).
	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.

Sensitivity	Typical Criteria/ Indicator of Value
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. – **Dilution and Removal of Waste Products:** Few existing licenced discharges/ low daily volume of discharges to or within 50m of water feature under CAR relative to flow **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 recreational land and/or affecting <10 industrial premises or high value agriculture (e.g. arable pastures, complex cultivation patterns and agro- forestry) in a 1 in 200-year event (0.5% AEP).
	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. – **Dilution and Removal of Waste Products:** No existing licenced discharges to or within 50m of the water feature under CAR **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 (e.g. rough grazing land) or receptors in a 1 in 200-year event (0.5% AEP).

Sensitivity	Typical Criteria/ Indicator of Value
	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

11.2.45 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). – Total removal of the water feature's capacity to dilute licensed discharges under CAR **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.

Magnitude	Typical Criteria
	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. – Reduction in the water feature's capacity to dilute existing discharges under CAR **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.
	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.

Magnitude	Typical Criteria
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 – Slight reduction in the water feature's capacity to dilute existing discharges under CAR **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%.
	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.

Magnitude	Typical Criteria
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.
	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.

Magnitude	Typical Criteria
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

11.2.46 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

11.2.47 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

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

Water Quality

11.2.49 Surface water quality data was obtained from SEPA for the DMRB Stage 3 assessment, and surface and groundwater quality has been established via ground investigation (GI) works during the DMRB Stage 3 process. However, the majority of watercourses within the Proposed Scheme extent do not have a WFD classification and the GI data is limited to larger watercourses, therefore; assessment of existing water quality has included consideration of other relevant environmental factors (e.g. surrounding land-use). Where WFD classifications are available, a summary of these is provided in **section 11.3**.

11.2.50 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:

- 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

11.2.51 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 THC, and is described in greater detail, along with limitations relating to modelling uncertainties in **Appendix 11.3** (**Volume 2**).

Hydromorphology

11.2.52 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 **11.12, Volume 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.

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

11.3.4 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

11.3.5 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.

11.3.6 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 (from date of publication), and longer to 2027

11.3.7 The baseline information and classifications are used to prevent the Proposed Scheme having a deleterious/ detrimental effect on the WFD status of watercourses within the study area.

Common Baseline Conditions

11.3.8 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

11.3.9 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.

11.3.10 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 Spey may support salmon species and so a conservative estimation of their water quality sensitivity has been adopted.

Groundwater Quality

11.3.11 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 assigned 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
40,000 to 43,500	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)
43,500 to 44,000	Vulnerability class 4b – Vulnerable to those pollutants not readily adsorbed or transformed. More likely to have clay present in superficial deposits (therefore generally lower vulnerability than 4a)
44,000 to 44,350	Vulnerability class 4a
44,350 to 45,550	Vulnerability class 3 – Vulnerable to some pollutants; many others significantly attenuated
45,550 to 47,400	Vulnerability class 4a
47,400 to 47,600	Vulnerability class 3
47,600 to 48,300	Vulnerability class 4a
48,300 to 48,600	Vulnerability class 2 – Vulnerable to some pollutants, but only when they are continuously discharged/ leached
48,600 to 50,250	Vulnerability class 4a
50,200 to 50,300	Vulnerability class 3
50,300 to 52,000	Vulnerability class 4a
52,000 to 52,650	Vulnerability class 3

Chainage (ch.)	Vulnerability class
52,650 to 54,200	Vulnerability class 4a
54,200 to 54,450	Vulnerability class 3
54,450 to 56,950	Vulnerability class 4a

Hydrology and Flood Risk

11.3.12 A Local Flood Risk Management Plan for Findhorn, Nairn and Speyside was published by Moray Council in June, 2016. It outlines the risks to Newtonmore and Kingussie, as receptors of flooding, in the Potentially Vulnerable Area (PVA) factsheets PVA 05/13 and PVA 05/12, respectively. PVA 05/13 notes that there are two sections of the A9, with a total length of 370m, at risk from flooding, and PVA 05/12 notes three sections with a total length of 50m at risk; however, the exact locations are unclear and the mechanisms of flooding are not described.

11.3.13 The baseline hydraulic modelling of the River Spey (and tributaries) identifies existing flood risk to the A9 due to undersized culverts at specific watercourse crossings. The modelling output is shown on the Flood Extent Plans (**Drawings 11.18 to 11.22** in **Volume 3**) and further detail provided in the Water Features Survey (**Appendix 11.1**) and Flood Risk Assessment (**Appendix 11.3)**, both in **Volume 2**.

11.3.14 Flooding from the River Spey is extensive throughout the study area for the 1 in 200 year return period. The floodplains of both banks potentially impact upon residential and non-residential properties (e.g. Kingussie), critical infrastructure (A9, HML railway), and sensitive environmental receptors identified by SEPA with potential economic implications e.g. cultural heritage sites, local agricultural land.

Hydromorphology

11.3.15 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, narrow channels, 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 Truim (MW 8.1)

11.3.16 The River Truim is a major right bank tributary of the River Spey draining the western edges of the Cairngorms with a catchment area of 125km^2, as shown in **Drawings 11.1** (**Volume 3**). Its headwaters are situated in the Pass of Drumochter, approximately 8km south of Dalwhinnie. It flows adjacent to Project 9 from south of Bridge of Truim to its confluence with the River Spey approximately 1.8km further downstream.

11.3.17 It has a WFD classification of 'Moderate ecological potential' – lower catchment (2016). It is designated as part of the River Spey Special Area of Conservation (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 (as discussed in **Chapter 12**); therefore, overall the watercourse has been assessed as having a **Very High** sensitivity value for water quality.

11.3.18 SEPA WFD classification for Upper Spey Sands and Gravel is determined as 'Good'. BGS data for this section of the Truim indicates that the waterbody is within a high groundwater vulnerability zone (Class 4); therefore a **High** sensitivity has been assigned.

11.3.19 The watercourse continues lateral migration, working into the glacial deposits, transporting and depositing materials, exhibited by sinuous meandering and braided planforms. Therefore, a **High** hydromorphological sensitivity value has been assigned.

11.3.20 The section of the River Truim within Project 9 is located at least 160m from in plan and 25m lower than the existing A9 and does not present any flood risk to sensitive receptors within the Proposed Scheme extent; therefore a **Low** sensitivity value is assigned.

River Spey (MW 9.1/ Hydro ID 152)

11.3.21 The River Spey is the dominant watercourse within the Project 9 extent, as shown in **Drawings 11.2** to **11.12** (**Volume 3**). The Spey flows for 157km from its source in the Monadhliath Mountains to the Moray Firth.

11.3.22 Many of its tributaries have sources in the steeper upper catchment within the Cairngorms Mountains. These watercourses are capable of generating high energy flows and introduce large volumes of coarse sediment, comprised of bedrock and fluvio-glacial deposits, into the main channel. The gentler gradients of the wider valley floors result in lower energy flows and subsequent deposition of this coarse material; this has been noted by channel narrowing at confluences with the River Spey.

11.3.23 The Spey is a designated SAC for species including Atlantic salmon and freshwater pearl mussel which are susceptible to changes in the sediment regime, channel morphology and fluvial processes of the river. Modifications within the catchment including abstractions, drainage, bridges and culverts etc. have led to changes in flow and sediment dynamics; as well as hydro schemes including which alter the hydrological regime of the river. It is classified as 'Good Ecological Potential' under the WFD River Basin Management Plan (2016) due to the presence of two hydroelectricity schemes operating in the upper catchment; the Tromie/ Truim tributaries and at Spey Dam. Overall, the watercourse has been assessed as having a **Very High** sensitivity value for water quality due to the various factors described above.

11.3.24 The river has an actively meandering planform and is working into a floodplain which is comprised of fluvio-glacial deposits (alluvium - clay, silt and sand, and till). Mid-channel and lateral gravel bars are evident throughout the river reaches, many with fully established vegetation cover. The river has retained a gravel-bed channel due to this continued lateral migration working into the glacial deposits, transporting and depositing materials exhibited by sinuous meandering and braided planforms.

11.3.25 Aerial photography and historic mapping indicates numerous meander cut-offs and abandoned channels; within Project 9 this is notable around Ballochbuie Island east of the A9 Spey crossing at Kingussie. Right-hand bank undercutting into agricultural land is noted west of the Spey crossing as the river approaches the existing bridge. Deposition of material ranging from pebble to boulder is evident on the floodplain beneath the crossing. Bank protection has been implemented with stone gabions on the left bank below the bridge. The existing crossing restricts natural geomorphological processes, fixing the position of the existing banks. This has

also resulted in scouring of existing bridge piers. Overall, a **Very High** sensitivity value has been assigned for hydromorphology.

11.3.26 The baseline hydraulic modelling highlights flooding at sensitive receptor locations throughout the Project 9 extent at the 1 in 200-year return period, including; residential and non-residential properties (Newtonmore, Nuide, Kingussie, and Balavil); roads (B9150/ Perth Road, B970/ Ruthven Road, A86, B9152); the HML railway, cultural heritage (Ruthven Barracks); recreational areas, agricultural land. The 200yr floodplain of the River Spey is predicted to reach the foot of the existing A9 at three locations within Project 9 (ch.49,300 to ch.50,200, ch.50,675 to ch.50,750, and ch.53,000 to ch.53,100), though not predicted to overtop the road. Overall, a **Very High** sensitivity value has been assigned.

Photographs 11- 1: River Spey

A) River Spey looking upstream from north embankment by Kingussie. The existing Spey crossing is seen to the left of photograph.

B) River Spey looking downstream. Confluence with the Gynack Burn to the left of photograph

C) River Spey looking upstream from south embankment opposite to Kingussie.

D) River Spey looking downstream from north embankment opposite Kingussie.

Allt Torr an Daimh (MW 9.2/ Hydro ID 138_2) and Unnamed Tributary (MW 9.2a)

11.3.27 The Allt Torr an Daimh is a 570m single channel right bank tributary to the River Spey flowing through a wide valley with gently sloping sides both upstream and downstream of the A9. It flows through an area of wet and riparian woodland/ scrub upstream of the road and blanket bog/ fens downstream. It crosses the A9 through a 1200mm concrete pipe before joining with a floodplain tributary (MW9.2a) and discharging to the Spey (**Drawing 11.2** in **Volume 3**).

11.3.28 The watercourse is not classified by SEPA and no water quality information was available. It is not known to support any designated freshwater-dependent ecosystems and it will receive a degree of road runoff from the existing A9; therefore, a **Low** sensitivity has been assigned for water quality.

11.3.29 Licenced discharge DISC 9.4 (septic tank effluent (STE) to soakaway) is located approximately 130m to the west of the A9 by Ralia Centre. BGS data indicates that the waterbody is within a high groundwater vulnerability zone (Class 4); therefore a **High** sensitivity has been assigned.

11.3.30 To the east of the A9, the watercourse has incised into hummocky glacial deposits and peat; to the west the channel flows along a flat gradient of the Spey floodplain comprised of glacio-fluvial terraced deposits before joining the main watercourse. The channels are straight and narrow (c. <1m), and heavily vegetated with concrete headwalls at the culvert. Upstream, in-channel material sizes range from boulder to gravel; downstream material sizes range from boulders to fine; and varied sediment size accumulation is noted within the culvert. Overall, a **Medium** sensitivity value has been assigned for hydromorphology.

11.3.31 No flooding issues have been identified for this watercourse; therefore a **Low** sensitivity value has been assigned.

Photographs 11- 2: Allt Torr an Daimh (MW 9.2/ Hydro ID 138_1)

A) Metal sluice upstream of A9 B) Upstream of A9 looking towards inlet C) Downstream outlet under A9 looking east

Caochan Riabhach (MW 9.3/ Hydro ID 142)

11.3.32 Caochan Riabhach is a right bank tributary to the River Spey which flows for 610m from headwaters at approximately 250mAOD to the River Spey at approximately 245mAOD. Upstream of the A9 crossing W9.5 flows for 150m before joining the Caochan Riabhach and continuing on a narrow, and relatively straight, shallow channel through a wooded area (**Drawing 11.3** in **Volume 3**).

11.3.33 Both watercourses are unclassified by SEPA and no water quality information was available. They have a combined catchment area of 0.71km^2. The watercourses will receive a degree of road runoff from the existing A9 and three STE to soakaway discharges (DISC 9.10, DISC 9.11, and DISC 9.12) are located within the Ralia Lodge site; however, these are approximately 100m to the east of the watercourses, therefore, they been assigned a **Low** sensitivity value.

11.3.34 Although classed as a 'Major' watercourse (i.e. shown on OS 1:50K mapping), Caochan Riabhach (MW9.3) is a small channel draining a boggy area upstream of the existing road cutting. The channel downstream of the crossing has been realigned, likely during railway construction to take

flow from this and other channels through a single point in the railway embankment. The channel is vegetated indicating a level of stability with limited morphological activity in the catchment overall; therefore, a **Low** sensitivity value for hydromorphology has been assigned.

11.3.35 Hydraulic modelling indicates Caochan Riabhach (MW9.3) overtops and floods the access road to the west of Ralia Lodge in a 200-year event as well as impacting on the HML railway embankments. As the railway is classed as essential infrastructure, but it not directly overtopped, and access/ egress to/ from Ralia Lodge can also be made from the east, a **High** sensitivity value has been assigned.

Photographs 11- 3: Caochan Riabhach (MW9.3/ Hydro ID 142)

A) Upstream looking towards A9 B) Looking upstream from A9 inlet C) Downstream of A9 looking towards outlet

Allt Eoghainn (MW 9.4/ Hydro ID 145)

11.3.36 The Allt Eoghainn is a stable right bank tributary of the River Spey (catchment area approximately 2.2km^2) with its headwaters, southwest of the summit of Ordan Shios, in Nuide Moss at an elevation of approximately 325mAOD. It crosses the existing A9 through an 1800mm culvert, downstream of which, it becomes part of a field drainage system and flows for another 2.2km through straightened field-edge boundary channels before reaching the Spey (**Drawing 11.4** in **Volume 3**). It is likely to be affected by acidification due to the land cover and receive a degree of road runoff from the existing A9, though it is not classified by SEPA and no water quality information was available; therefore it has been assigned a **Low** sensitivity.

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

11.3.38 Downstream of the existing A9 crossing, the channel flows through a relatively low gradient, confined valley bottom with little evidence of recent erosion of the valley sides through to substrate. Upstream of the crossing, it has a meandering planform in the upland section, incising into glacio-fluvial sheet deposits (sand, gravel and boulders) as it flows in a north-easterly direction for 2.8km across a relatively flat heather and grass summit, down to the A9 crossing at 250mAOD. On the hillsides surrounding the Nuide Moss, there is evidence of shallow failure exposing substrate, a possible supply of sediment to the channel ranging in size from gravel to boulder evident upstream of the crossing trash screen. Due to length of modified channel downstream of the crossing, a **Medium** sensitivity value has been assigned.

11.3.39 Hydraulic modelling indicates the watercourse overtops and floods the access road to Nuide in a 1 in 200-year event; therefore, a **High** sensitivity value has been assigned.

Photographs 11- 4: Allt Eoghainn (MW9.4/ Hydro ID 145)

A) Upstream of A9

B) Downstream of A9 outlet

C) Downstream of A9

Milton Burn/ Inverton Burn (MW 9.6/ Hydro ID 147)

11.3.40 Milton Burn is a right bank tributary of the River Spey (catchment area approximately 34.22km^2) with headwaters below the summit of Creag nam Bodach at Loch an Dabhaich where it flows through moorland, cutting into alluvium and glacio-fluvial sheet deposits (sand, gravel and boulders) before entering the main channel south of Kingussie (**Drawing 11.5** in **Volume 3**). It has a WFD classification of 'Good' (2016) and is designated as part of the River Spey SAC for species including; Atlantic salmon, otter, sea lamprey, and freshwater pearl mussel. Further detail on the particular species present is provided in **Chapter 12**.

11.3.41 BGS data indicates that the waterbody is within a high groundwater vulnerability zone (Class 4); therefore a **High** sensitivity value has been assigned. Abstraction (ABS 9.4) is noted approximately 75m to the west of the watercourse.

11.3.42 Upstream of the crossing the channel is narrow, confined by right-side glacial terrace with exposed cobbles and boulders in a matrix of coarser sand. Downstream is a wide valley with gently sloping sides and sections of unprotected earth banks. In the straighter sections there is evidence of riffle flow indicating variance of bed profile and material size; the lower reaches are noted as an important spawning area for both salmon and trout. The channel is stable, well vegetated upstream with transport of material noted throughout, and deposition and gravel bed formation noted within the culvert. Overall, a **High** sensitivity value has been assigned for hydromorphology.

11.3.43 Hydraulic modelling indicates the watercourse is out of bank in a 200-year event, flooding agricultural land for much of its length upstream of the A9, also impacting the embankments of the road itself. Downstream of the A9 it floods the access road to Inverton therefore, a **High** sensitivity value has been assigned.

Photographs 11- 5: Milton Burn/ Inverton Burn (MW 9.6/ Hydro ID 147)

A) Crossing at A9 under two bridging culverts (third is underpass) B) Downstream of A9 looking toward access crossing

Unnamed (MW 9.11/ Hydro ID 155)

11.3.44 This unnamed watercourse is a left bank tributary of the River Spey (catchment area approximately 0.7km^2) entering the main channel east of Kingussie. It crosses the A9 via a 1200mm culvert and continues a further 1.2km before discharging into the Spey. It is likely to be affected by acidification due to the land cover and receive a degree of road runoff from the existing A9, though it is not classified by SEPA and no water quality information was available; therefore it has been assigned a **Low** sensitivity value.

11.3.45 BGS data indicates that the waterbody is within a high groundwater vulnerability zone (Class 4); therefore, a **High** sensitivity value has been assigned. The Kerrow Farm, STE to land discharge (DISC 9.28) is approximately 200m to the south-west of the watercourse at approximately ch. 51,050 (**Drawing 11.8** in **Volume 3**).

11.3.46 It is comprised of straightened ditches (including several ninety-degree turns around field boundaries) in a wide valley with gently sloping sides flowing over till formation alluvial fan deposits and peat. There are sections lined with concrete banks and it is vegetated along much of its length. Fine sediment size and plane bed morphology is noted throughout with the channel appearing stable. Most of the channel in the upper catchment has a natural planform although the dams and straightening through the golf course will have altered the flow and sediment transport regiment. However, within the natural sections of channel there will be varied form and flow conditions and a range of sediment sizes. In the vicinity of the A9 the channel has been realigned and re-sectioned; therefore, a **Medium** sensitivity value has been assigned.

11.3.47 Hydraulic modelling indicates the watercourse is out of bank in a 200-year event upstream of the A9, overtopping the road and flooding residential properties further downstream at Laggan. The B9152 road and the HML railway are also affected by flooding at this location; therefore, a **Very High** sensitivity value has been assigned.

Photographs 11- 6: Unnamed watercourse (MW 9.11/ Hydro ID 155)

A) Upstream of A9 crossing B) Downstream of A9 outlet

Allt Cealgach (MW 9.12/ Hydro ID 157)

11.3.48 The Allt Cealgach is a left bank tributary of the River Spey with a catchment area of approximately 3.1km^2, flowing 5.3km from headwaters at 380mAOD. It flows through a wooded area on the upstream side of the existing A9, and crosses the existing road through a 1500mm bridge structure. Downstream of the road the channel has been incorporated into field a drainage system and the watercourse flows into a pond (P9.20) approximately 350m downstream of the road (**Drawing 11.8** in **Volume 3**). It is likely to be affected by acidification due to the land cover and receive a degree of road runoff from the existing A9, though it is not classified by SEPA and no water quality information was available; therefore, it has been assigned a **Low** sensitivity value.

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

11.3.50 It has several smaller tributaries in the upper reaches, and has a meandering planform following the contours of the higher ground. Its confluence with the Spey is located 1km to the east of Kingussie at 224mAOD. In the upper reaches the channel has incised into till formations and alluvial fan deposits in the vicinity of the A9. Upstream of the A9 the channel is single thread with step-pool morphology and formation of a large mid-channel bar comprised of boulders to fines. In-channel scour down to bedrock and bank erosion is also evident upstream.

11.3.51 Downstream there is evidence of avulsion; large scale deposition on both banks has resulted in flow path change shown by overland flow routes across fields, gravels on floodplain from out-of-bank events, and a dry channel previously evident on mapping and aerial photography. This has resulted in a multi-thread downstream channel with fan and braided features. The gravels on floodplain now exhibit vegetation establishment indicating a period of stability. Overall a **High** sensitivity value has been assigned for hydromorphology.

11.3.52 Hydraulic modelling indicates the watercourse is out of bank in a 200-year event upstream of the A9, overtopping the road and flooding agricultural land further downstream. The B9152 road and the HML railway are also affected by flooding at this location though the direct source of this is unclear; therefore, a **Very High** sensitivity value has been assigned.

Photographs 11- 7: Allt Cealgach (MW 9.12/ Hydro ID 157)

A) Large volume of deposited materials upstream of A9 crossing B) Out-of-bank flow and deposition of material downstream of A9

Raitts Burn (MW 9.14/ Hydro ID 162)

11.3.53 Raitts Burn is a single thread left bank tributary of the River Spey flowing approximately 7km south-eastwards across the north-western flank of Strathspey, draining an ice-scoured hollow (c. 1.5km^2 in diameter), to join the valley of the River Spey 3km downstream of Kingussie (**Drawing 11.10** in **Volume 3**). It has a WFD classification of 'Moderate' (2016) and the lower reaches of the watercourse are designated as part of the 'Insh Marshes' and 'River Spey' SACs, and the 'River Spey-Insh Marshes' SSSI, SPA, and Ramsar site. Overall, a **High** sensitivity value has been assigned for water quality.

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

11.3.55 It has a meandering planform, cutting into till, diamicton and alluvium bordered by areas of talus, following natural gradient of the hillslopes and passing over a waterfall in the upper reaches. The channel planform is straight directly upstream and downstream of the crossing set within a wide valley with gentle slopes. Between the HML railway and the B9152 road, mid-channel deposition of materials ranging from gravel to boulder has led to constriction and subsequent backing up of flow beneath both road and railway bridges and further deposition of fines on the embankments. Overall, a **High** sensitivity value has been assigned for hydromorphology.

11.3.56 Hydraulic modelling indicates the watercourse is out of bank in a 200-year event upstream of the A9, impacting the road embankment and flooding agricultural land in close proximity to residential properties. The B9152 road and the HML railway are also affected by flooding at this location; therefore, a **Very High** sensitivity value has been assigned.

Photographs 11- 8: Raitts Burn (MW 9.14/ Hydro ID 162)

A) Upstream of A9 crossing (looking south)

B) Upstream of B9152 – large volume of sediment constricting flow

Unnamed (MW 9.17/ Hydro ID 170)

11.3.57 This small unnamed watercourse (catchment area approximately 1.4km^2) is denoted as a 'Drain' on OS mapping and flows through the eastern edges of the Highland Wildlife Park north of the existing A9. It crosses the road through a 1200mm culvert at Hydro ID 170 (**Drawing 11.12** in **Volume 3**. It is not classified by SEPA and no water quality information was available. As it flows through wooded areas and will likely receive a degree of road runoff from the existing A9, it has been a **Low** sensitivity value.

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

11.3.59 This watercourse is a single thread channel that appears to be stable. The catchment is well vegetated and there appears to be little sediment supply to the channel. There is limited geomorphic diversity around the existing A9 crossing; however, a **Medium** hydromorphology sensitivity value has been assigned as much of the channel and flow is unmodified.

11.3.60 Hydraulic modelling indicates the watercourse is out of bank in a 200-year event upstream of the A9, impacting the road embankment. The B9152 road and the HML railway are also affected by flooding at this location; therefore a **Very High** sensitivity value has been assigned.

Photographs 11- 9: Unnamed watercourse (MW 9.17/ Hydro ID 170)

A) Upstream of A9 crossing (looking south)

B) Upstream of A9 crossing (looking north)

Other Water Features

Ponds

11.3.61 Approximately 45 pond/ standing waterbodies (some ephemeral), ranging from <0.001km^2 to 0.03km^2 in area, have been identified within 200m of the existing road corridor in the Project 9 'DMRB Stage 3 Wider Study Area'. The majority are unlikely to be impacted by the Proposed Scheme as they are beyond earthworks extents. However, some are noted as being of particular importance due to their potential habitat for species such as water vole (e.g. P9.2 and P9.24), geodiversity (i.e. Lochan an Tairbh (P9.15)), or value as a community asset (i.e. Glebe Ponds (P9.18); therefore, they are included as part of the water features survey. Further information on community assets, geodiversity, and ecological conditions is provided in **Chapters 8**, **10**, **and 12**, respectively.

Photographs 11- 10: Lochan an Tairbh (P9.15)

Photographs 11- 11: Glebe Ponds (P9.18)

Private Water Supplies

11.3.62 Private water supplies (PWS) are also identified within the Project 9 extent. Based on the consultations undertaken with residents, and questionnaire responses/ feedback received at the time of writing (November 2017), 20 PWS source locations were identified supplying properties at Glentruim, Ralia, Nuide Farm, Balavil Estate, Inverton and Ruthven. Fifteen possible well features were also identified based on current or historical Ordnance Survey mapping. Further information on PWS is provided in **Appendix 10.3** and associated drawings in **Volume 3**. Only those PWS within the 'DMRB3 Wider Study Area' are included in the Water Features Schedule in **Appendix 11.1**.

Discharges

11.3.63 Consented point source discharges are identified from CAR licence information received from SEPA. They include discharges from private residential, commercial and agricultural sources, often associated with septic tank outfalls to soakaways, land or surface watercourses. Although many are outwith the 'DMRB Stage 3 Detailed Study Area' they are considered within the survey 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. A complete list of discharges is provided in **Appendix 11.1** with further detail as potential sources of pollution provided in **Appendix 10.4**.

Abstractions (obtained from EnviroCentre Spey Abstractions Report (2008))

11.3.64 The headwaters in the west of the Spey catchment have been utilised for hydro-electric power generation by Alcan and SSE. The transfer structures comprise of intake weirs and dams, with the three dams being the Spey Dam (Alcan), Loch an t-Seilich and Loch Cuaich (both SSE). This regulated area extends to 390km^2, or 13% of the entire catchment to Spey Bay, although the influence of this is greater in the upper reaches of the main catchment being 32% to Aviemore and 54% to the Spey/ Tromie confluence. At the intakes, the flows are diverted and transferred out of the Spey catchment into surrounding catchments. There are only four intakes that release compensation flows back into the Spey below them. The only other time water passes over the intakes is during high flows when the capacity of the intake is exceeded.

11.3.65 The waters to the north-west are transferred west towards Loch Laggan in the River Spean catchment, eventually being used to generate electricity at the Alcan plant in Fort William before being discharged to Loch Linnhe. The waters to the south-west are transferred south west by SSE to Loch Ericht in the Tay catchment and into the Tummel hydroelectric scheme, before discharging into the Firth of Tay at Perth.

Key receptors

11.3.66 Key sensitive receptors at risk of flooding 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 Project 9 extent that may be affected by the Proposed Scheme include: residential and non-residential properties; roads and railway line; utilities; environmental designated sites; cultural heritage sites; community services; and higher value agricultural land.

11.3.67 Specific receptors identified as potentially being at risk of flooding in existing conditions in a 1 in 200-year event are; properties at Nuide and Chapelpark, the HML railway, the BDL access track, the B9150, the B9152 and the NCN7. As essential infrastructure, the A9 itself is also identified as a sensitive receptor. The Proposed Scheme is designed above the 200-year flood level in line with Scottish Planning Policy to minimise operational impacts during extreme events.

11.3.68 Properties at Newtonmore and Kingussie have also been identified as potentially being at risk of flooding in existing conditions. While these properties are outwith the Project 9 water environment study area boundary, Scottish Planning Policy (SPP) suggests that no increase in flood risk should occur elsewhere as a result of the Proposed Scheme, they are therefore, considered as part of the Flood Risk Assessment (FRA) (**Appendix 11.3, Volume 2**).

Assigned sensitivities

11.3.69 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 outlined in **section 11.2**:

- Water quality (including groundwater): Water quality, 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

11.3.70 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.

11.3.71 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 periodic monitoring as part of a routine maintenance and inspection regime, 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 (25No.) and access tracks (10No.) via pipes (700 to 1500mm) and box culverts (1500 x 1250mm to 2700 x 2100mm); earthworks associated with road widening; 41 watercourse realignments upstream and downstream of the Proposed Scheme mainline and access tracks; replacement of seven bridges including the River Spey crossing at Kingussie (six mainline and one junction); 14 SuDS basins/ ponds and associated outfalls; drainage channels and associated outfalls; stepped channels or cascades; and compensatory flood storage to offset floodplain encroachments.

Embedded mitigation

11.4.3 Throughout the DMRB Stage 3 iterative design process, a series of environmental workshops considered each aspect of the developing design and made recommendations for certain features to be included in the Proposed Scheme design. These aspects have been defined as 'embedded mitigation' and are considered within the context of the impact assessment as providing mitigation to avoid or reduce potential environmental impacts, and in some cases, they also provide environmental enhancement.

11.4.4 With respect to the topics under consideration in this chapter, details of ‘embedded mitigation’ developed during the design process (now incorporated into the Proposed Scheme) are outlined

in **Table 11- 5**, along with the potential impacts these measures are designed to mitigate. During later detailed design, any alternative forms of mitigation proposed will be subject to appropriate assessment and agreement with concerned authorities (e.g. SEPA and THC).

11.4.5 While the impact assessment is undertaken in cognisance of the embedded mitigation features, in order to capture all project mitigation requirements (including embedded, specific and generic mitigation), they have been included within **section 11.5** of this chapter, and the Schedule of Environmental Commitments contained in **Chapter 21**.

Table 11- 5 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, etc.) 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 (or another form of chemical weed suppressant) 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 *Beyond the initial contractor maintenance period, regular inspection and maintenance (including drainage networks and SuDS features) will be undertaken by the relevant Trunk Road Operating Company.	• 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 deemed inappropriate as a form of treatment, or permanently wetted areas are required for ecological enhancement, SuDS are lined to prevent groundwater contamination and/ or drying out of a micro-pool/ pond • Inclusion of spillage containment features in SuDS facilities (emergency shut-off valve on basin outlet) to minimise spillage risk to receiving watercourses
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 mainline watercourse crossings to a minimum of 900mm, where possible, 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 recommended freeboard is set to one quarter of the height) • Raising road levels to accommodate for these increases and also provide greater freeboard above the functional floodplain • Providing SuDS to attenuate increased surface runoff • Compensatory storage areas (CSAs) are included to offset flood storage volume lost due to encroachments (mainline, access, SuDS) into the functional floodplain** • Re-grading of cutting and embankment slopes to reduce floodplain encroachment • SuDS have been sized to control significant rainfall up to the 0.5% AEP (1 in 200 year return period) event whilst restricting outflow to 'greenfield' or existing runoff rates • Dispersal trenches to maintain surface water supply to potentially sensitive habitats **Storage and reinstatement of excavated materials associated with construction of CSAs should comply with good practice guidance and methods stipulated in **Chapter 10** and **Appendix 10.6**

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 (catchment pits, weirs etc.), 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 minimise or avoid scour protection requirements • Creating a natural bed through culverts and providing step-pools through steep culverts to dissipate energy • Provide 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 erosion effects, and improve stability of channels • Position access tracks to improve watercourse morphology

Other Design Drivers Considered

11.4.6 Other design drivers also considered include:

- Operational factors i.e. where maintenance issues require upsizing of culverts to allow inspection and/ or debris removal to be carried out effectively; retaining existing pipe size as not to impact existing asset functionality
- 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 maintain and improve permeability where possible throughout the route

Specific Construction-phase Activities

11.4.7 **Table 11- 6** 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**. **Table 11- 7** outlines the proposed SuDS treatments for the Project 9 drainage networks. Further details of mainline and junction infrastructure, structures, watercourse crossings, and drainage are outlined in **Chapter 5**.

Note: SEPA guidance (WAT-RM-08) highlights that sediment removal is an essential part of the treatment for surface water discharges (especially during the construction phase, during which the risk of pollution is high) and that the performance of the final SuDS scheme will be seriously jeopardised if it becomes contaminated during the construction phase of a site development and so suitable protection or the timing of the permanent SuDS construction will need to be carefully considered; hence the permanent or operational-phase SuDS components should not be used to manage construction runoff.

Table 11- 6 Summary of specific construction-phase activities on or near major watercourses

Water Feature	Chainage (ch.)	Construction Activity
River Truim (MW 8.1)	N/A	No construction works are planned on or near this watercourse
River Spey (MW 9.1/ Hydro ID 152)	41,950 49,250 50,150	Works (temporary and permanent) associated with SuDS 417 outfall Works (temporary and permanent) associated with SuDS 490 and 493 outfalls Removal of existing and construction of new River Spey Bridge
Allt Torr an Daimh (MW 9.2/ Hydro ID 138_2)	42,100	Road widening and earthworks associated with new A9 southbound carriageway Existing crossing is being replaced with a 1500mm culvert (length = 40.13m) with natural bed material to be included in culvert and provision of mammal crossing. Upstream and downstream watercourse diversions Works (temporary and permanent) associated with picnic area access track
Caochan Riabhach (MW 9.3/ Hydro ID 142)	43,800	Road widening and earthworks associated with new A9 southbound carriageway Existing crossing is being replaced with a1500mm culvert (length = 51.97m) with natural bed material to be included in culvert and provision of mammal crossing. Upstream and downstream watercourse diversions Works (temporary and permanent) associated with Ralia access road upgrades

Water Feature	Chainage (ch.)	Construction Activity
Allt Eoghainn (MW 9.4/ Hydro ID 145)	45,650	Road widening and earthworks associated with new A9 southbound carriageway Existing crossing is being replaced with a 2700 x 2100 culvert (length = 76.77m) with natural bed material to be included in culvert and provision of mammal crossing. Upstream and downstream watercourse diversions Works (temporary and permanent) associated with SuDS 458 outfall
Milton Burn (MW 9.6/ Hydro ID 147)	47,400	Road widening and earthworks associated with new A9 southbound carriageway Removal of existing and construction of new Milton Burn underbridge Works (temporary and permanent) associated with SuDS 474 outfall
Unnamed watercourse (MW 9.11/ Hydro ID 155)	51,250	Earthworks associated with new offline A9 north and southbound carriageways Work associated with 2400 x1800 culvert (length = 46.73m) Upstream and downstream watercourse diversions Works associated with two access track watercourse crossings
Allt Cealgach (MW 9.12/ Hydro ID 157)	51,750	Road widening and earthworks associated with new A9 northbound carriageway Existing crossing is being replaced with a 2400 x 1500 culvert (length = 64.26m) with natural bed material to be included in culvert and provision of mammal crossing
Raitts Burn (MW 9.14/ Hydro ID 162)	53,450	Road widening and earthworks associated with new A9 northbound carriageway Removal of existing and construction of new Raitts Burn underbridge Works (temporary and permanent) associated with SuDS 534 outfall and access
Unnamed watercourse (MW 9.17/ Hydro ID 170)	56,200	Road widening and earthworks associated with new A9 northbound carriageway Existing crossing is being replaced with a1500 culvert (length = 64.74m) with natural bed material to be included in culvert

Table 11- 7: Summary of proposed SuDS features for drainage outfalls

SuDS ID	1st Level SuDS	2nd Level SuDS	Inclusion of Micro-pool[1]	Outfall Form	Outfall receiving water	Outfall Co-ordinates	
						Easting	Northing
417	Filter Drain	Basin	Yes	Grass-lined channel	River Spey (MW9.1)	269009	796782
427	Filter Drain	Pond	No	Grass-lined channel	Unnamed watercourse (W9.49a)	270400	796968
434	Filter Drain	Basin	Yes	Pipe to Pre-earthworks drainage ditch	River Spey (MW9.1)	270683	797609
458	Filter Drain	Basin	Yes	Grass-lined channel	Allt Eoghainn (MW9.4)	272877	798391
461	Filter Drain	Basin	Yes	Grass-lined channel	Unnamed watercourse (W9.11)	273108	798450
474	Filter Drain	Basin	Yes	Pipe to pre-earthworks drainage ditch	Milton Burn/ Inverton Burn (MW 9.6)	274467	798916

[1] 'A pool at the outlet that is permanently wet and improves the pollutant removal system. The ecological value of the system can also be enhanced by including micro-pools or wetland zones at the base' (CIRIA, 2015)

SuDS ID	1st Level SuDS	2nd Level SuDS	Inclusion of Micro-pool[1]	Outfall Form	Outfall receiving water	Outfall Co-ordinates	
						Easting	Northing
487	Filter Drain	Basin	Yes	Pipe to pre-earthworks drainage ditch	River Spey (MW9.1)	275646	799395
490	Filter Drain	Basin	Yes	Grass-lined channel	River Spey (MW9.1)	275980	799758
493	Filter Drain	Basin	Yes	Grass-lined channel	River Spey (MW9.1)	275980	799758
502	Filter Drain	Swale	No	Grass-lined channel	River Spey (MW9.1)	276605	800509
507	Filter Drain	Basin	No	Grass-lined channel	Unnamed Drain (MW9.10)	276705	801059
509	Filter Drain	Pond	No	Grass-lined channel	Unnamed Drain (MW9.10)	276770	801087
513	Filter Drain	Pond	No	Grass-lined channel	Unnamed watercourse (W9.26)	277081	801545
530	Filter Drain	Pond	No	Grass-lined channel	Unnamed watercourse (W9.27)	278505	801918
534	Filter Drain	Basin	Yes	Grass-lined channel	Raitts Burn (MW 9.14)	278954	802096
537	Filter Drain	Basin	Yes	Grass-lined channel	Unnamed Drain (W9.33)	279290	802326
561	Filter Drain	Tank Sewer & Vortex separator[2]	No	Swale	Unnamed watercourse (MW9.17)	281209	803669
563	Filter Drain	Tank Sewer & Vortex separator	No	Swale	Unnamed watercourse (MW9.17)	281202	803687

Note: the SuDS 'management train' included in the Proposed Scheme design is one of several equivalent options derived from the SuDS Manual (CIRIA, 2015). Any changes made to the design by the Contractor must be agreed through consultation with regulatory authorities, and still comply with the residual effects determined through the EIA process (i.e. be no worse than the Proposed Scheme).

Potential Construction-phase Impacts

11.4.8 Potential construction-phase impacts that may occur as a result of the activities outlined in **Table 11- 6** are discussed below. These works are on major watercourses requiring CAR consent; however, the same approach and considerations are also given to all other non-major watercourses, and appropriate construction techniques and guidance should be followed.

11.4.9 As the methods of construction and the type of appropriate mitigation are not defined at this stage, the significance of potential impacts is not provided here; however, it can be assumed that appropriate mitigation will be employed by the Contractor. Standard (scheme-wide) mitigation items to offset any potential construction-phase impacts are outlined in **Table 11-10** of **Section 11.5**.

[2] Due to spatial constraints, Networks 561 and 563 have one stage of treatment through filter drains and retained within a tank sewer and through proprietary SuDS before discharging via a swale.

Water Quality (Surface Water)

11.4.10 A primary concern is pollution from mobilised suspended solids generated by excavation and movement of materials. Settlement of these materials may occur some distance from the site of works and impact on the chemical and/ or ecological quality of a watercourse or other sensitive receptor.

11.4.11 Albeit a short-term activity, increased overland flow from removed vegetation and/ or compacted ground from heavy machinery, may contribute to changes to surface water drainage and inhibit infiltration. As runoff from construction sites can have increased levels of toxic elements comparative to routine runoff, this can also have an adverse impact on the chemical and/ or ecological quality of a watercourse or other sensitive receptor. Accumulation of toxic substances contained in sediment and runoff may also have detrimental impacts on aquatic flora and fauna if degradation or dispersal does not occur in sufficient time. Toxic substances from already contaminated land may enter the water environment via remobilisation of sediment due to disturbance of land.

11.4.12 The proximity of construction to watercourses may be a crucial factor in determining risk of pollution. Spatial constrains may result in construction near channel banks causing instability or destruction and releasing suspended solid materials.

11.4.13 Runoff from stockpiles, vehicle washings, pumping excavations, spillage of fuels, lubricants, hydraulic fluids and cement from construction plant, and leakage from fuel and materials storage areas may lead to adverse environmental incidents.

11.4.14 Accidental spillages from washing of plant or release of sewage can enter and pollute watercourses and groundwater and cause adverse impacts on flora and fauna. Further construction pollution types and sources are outlined in CIRIA C648 (Table 3.1).

Water Quality (Groundwater)

11.4.15 There is potential to impact groundwater quality in the vicinity of the works, and further afield, as dewatering may cause ingress of contaminated groundwater to the surrounding area.

11.4.16 Disturbance of contaminated land may impact on SuDS basins if they are not appropriately designed. Those that contain infiltration components may not be suitable for particular sites as this may remobilise pollutants that are dormant in the ground. SuDS basins and filter drains could also act as pathways for contamination to enter groundwater. Incorporation of liners to prevent infiltration into the underlying ground will enable the use of basins, swales, wetlands, and ponds on sites.

11.4.17 Groundwater abstractions may be vulnerable to temporary disturbance from work within or adjacent to watercourses.

11.4.18 Should accidental spillages occur during construction or operation, contamination may impact on groundwater within superficial deposits or bedrock and impair local groundwater quality. BGS information on groundwater vulnerability in Project 9 indicates all groundwater is vulnerable to this. However, the areas at highest risk are those in the vicinity of widenings and cuttings anticipated to intercept groundwater. Further detail is provided in **Chapter 10**.

Hydrology and Flood Risk

11.4.19 Potential impacts on hydrology and flood risk during construction of the Proposed Scheme may include; alteration of catchments (e.g. watercourse diversions), culvert and bridge construction resulting in flow constrictions, dewatering works, temporary drainage (e.g. drains, ditches, swales and SuDS) affecting hydrological and flow regimes on downstream watercourses, interception of groundwater flow causing waterlogging or groundwater flooding, and increased flood risk downstream or elsewhere of the Proposed Scheme due to change in runoff characteristics (e.g. increased runoff due to removal of vegetation and topsoil cover).

11.4.20 Temporary watercourse diversions may impact migration of salmon and other species. Sensitive timing of work will be needed to avoid the migration seasons. Further detail on ecological mitigation measures is provided in **Chapter 12**.

11.4.21 Localised flood risk may be increased by the presence of construction materials and/ or plant. These impacts are likely to be more severe during periods of intense or prolonged rainfall and construction on floodplains may reduce storage capacity, also increasing flood risk in the vicinity of works.

11.4.22 Temporary haul roads may cause a temporary increase in runoff due to reduced infiltration rates within the footprint of the works.

11.4.23 DMRB HD45/09 outlines construction methods that may also increase flood risk:

- Temporary paved surfaces or roofed areas of site compounds may increase the rate of runoff
- Any works within the floodplain are likely to affect the local hydrology
- Ditch or drainage diversions may affect catchment characteristics
- Temporary bunding or material stockpiles may alter runoff from upstream areas
- Large areas stripped of vegetation can discharge runoff at a much higher rate than if grassed, and some provision for temporary storage of surface water may be needed

Hydromorphology

11.4.24 By their nature culverts, bridges, realignments, and bank protection pose a risk to the geomorphology of the channel and floodplain as significant proportions of the required works (e.g. excavation, construction and landscaping) are located within, or in close proximity to, watercourses. Examples of potential impacts include:

- Damage to bank form
  - Engineering within the channel (culverts, bank protection, realignment, bridges and headwalls) may destabilise and permanently change the form of its banks
- Damage to bed form
  - Construction works within the channel may damage existing bed form (including areas of gravel bars, pools and steps), bed armouring and sediment composition of the bed. Works may also release fine sediment during construction that can potentially smother gravels at the site and further downstream, affecting ecological receptors
- Increased sediment supply

  - As both bed and banks may potentially become destabilised by the works, remobilised material is more likely to be delivered to the channel, and therefore, entrained and transported downstream

- Change in sediment dynamics
  - Increased sediment supply can lead to a change in sediment dynamics within the channel at the site of works, as well as downstream, and is likely to result in increased downstream transport and/or local deposition
- Change in flow conditions
  - Any temporary narrowing of the channel to create a dry working environment will alter the discharge, velocity and water levels of the channel
- Change of continuity of sediment transfer (excessive deposition or erosion)
  - Methods of construction that include impeding downstream sediment transport (e.g. damming the channel or over-pumping of water downstream) will temporarily reduce the downstream continuity of sediment transfer during the works, having an adverse impact on sediment continuity

Potential Operational-phase Impacts

11.4.25 All potential impacts have been assessed using the methods outlined in **section 11.2**. A summary of potential pre-mitigation impacts discussed in **Appendices 11.2** to **11.4 (Volume 2)** is provided below. These assessments capture 'embedded' mitigation that has been incorporated into the Proposed Scheme design, and report impact significance before inclusion of 'additional' mitigation.

11.4.26 Only impacts with significance greater than Neutral (adverse or beneficial) are outlined below with a summary of the sensitivity, magnitude of impact, and significance of impacts provided in **Table 11- 8**.

Water Quality (Surface Water)

11.4.27 With the exception of drainage network 537 (discharging to unnamed ditch W9.33), HAWRAT found that all drainage networks of the Proposed Scheme provide sufficient treatment (i.e. passing assessments for soluble and sediment-bound pollutants and not exceeding EQS values).

11.4.28 Network 537 passes with two levels of treatment (i.e. filter drain and 100% wet retention basin) for sediment-bound pollutants; however, HAWRAT produces a 'Fail' result for soluble copper (Cu) and zinc (Zn) and the EQS value for copper is exceeded by 0.1µg/l. This is due to the large road catchment area draining to this outfall point relative to the small area contributing to flows in the receiving watercourse.

11.4.29 Spatial constraints in this area inhibit the provision of additional treatment. Options to split the catchment have been investigated during design development; however, lack of suitable alternative outfall locations has prevented this. A supplementary assessment using alternate treatment measures (i.e. filter drain and grass-lined channel/ swale) produced a 'Pass' result; alternate SuDS treatment measures may be employed at this location if attenuation capacity is not compromised.

11.4.30 However; the Low sensitivity value of the watercourse, coupled with the Minor Adverse magnitude of impact, results in an overall Neutral significance of impact. Consequently, a 'Fail' of the HAWRAT routine runoff assessments does not necessitate a redesign or adoption of further mitigation.

11.4.31 The remaining drainage networks pass the assessment in the absence of mitigation or with the inclusion of the standard two stages of SuDS treatment. An overall improvement in water quality is predicted compared with the baseline conditions due to the first-time application of SuDS and a **Slight Beneficial** significance has been determined. Further detail is provided in **Appendix 11.2**.

11.4.32 Appropriate embedded mitigation (e.g. spillage containment features in SuDS facilities and emergency shut-off valve on basin outlets) has been incorporated into the design, therefore, surface water quality should not be adversely impacted as a result of accidental spillage. Furthermore, the risk of accidental spillage is significantly below the '1 in 200-year' threshold set by HD45/09. Further details are provided in **Appendix 11.2** (**Volume 2**).

Water Quality (Groundwater)

11.4.33 The water quality assessment (**Appendix 11.2**) identifies that potential impacts from routine runoff on groundwater for all 19 drainage networks produced risk scores >190. This relates/converts to a 'Medium' impact score (DMRB) which translates to a Moderate Adverse magnitude of impact as set out by the criteria in **section 11.2**. As the groundwater sensitivities throughout the Proposed Scheme extents range from Low to Very High, the significance of impacts vary between **Slight Adverse** and **Very Large Adverse** without mitigation.

Hydrology

11.4.34 Existing catchments and overland flow paths are not significantly altered by the watercourse diversions and drainage layout of the Proposed Scheme; therefore, no adverse impact to sensitive ecosystems and/ or social economic uses is envisaged.

Flood Risk

11.4.35 Potential flood risk impacts to the Proposed Scheme, and to other sensitive receptors, have been avoided or reduced where practicable during the iterative design process. Where this has not been fully achievable, compensatory flood storage areas (CSAs) have been incorporated (defined as 'embedded mitigation') to offset any loss of functional floodplain storage in accordance with Scottish Planning Policy (SPP) and SEPA guidance.

11.4.36 Provision of CSAs as mitigation may not be appropriate where other potential impacts arise as a consequence e.g. sensitive habitats, deep peat, community and private assets. Therefore, where an encroachment into the functional floodplain cannot be fully addressed by compensatory storage details are provided in the Flood Risk Assessment (**Appendix 11.3**).

11.4.37 For the majority of receptors, their sensitivity value and/ or magnitude of impact has resulted in a Neutral significance of impacts. Those with High or Very High sensitivities have been identified as having Minor to Major (adverse or beneficial) magnitude of impact resulting in pre-mitigation significance of impacts ranging from **Very Large Adverse** to **Very Large Beneficial** throughout the Proposed Scheme extent. Details are provided in **Table 11- 8**.

Hydromorphology

11.4.38 Proposed works in close proximity to the numerous watercourses crossed by the A9 in the study area have been found to have both adverse and beneficial significance of impact on the hydromorphology of the water environment dependent on the construction activity. The scale of the works relative to the size of the watercourses has been used to determine if the watercourse can 'absorb' the impact of the Proposed Scheme without adversely affecting the overall WFD status.

11.4.39 In total, ten watercourses with Medium to Very High sensitivity values were found to have a greater than neutral significance of impact (Moderate Adverse to Major Beneficial) based on proposed engineering activities resulting in pre-mitigation significance of impacts ranging from **Moderate Adverse** to **Large Beneficial**. Multiple engineering activities are undertaken on individual watercourses, each activity is assessed separately and a significance of impact determined. Details of each engineering activity and associated significance are reported in **Appendix 11.4** (and **Annexes**) (**Volume 2**) and summarised in **Table 11- 8**.

Dellmore of Kingussie

11.4.40 Proposals to create circa 20 hectares of wader habitat at the Dellmore of Kingussie (ch. 48,250 to 49,300) are intended to mitigate loss of habitat in the Insh Marshes National Nature Reserve (NNR) associated with the construction of the new River Spey crossing (Hydro ID 152). An assessment of the hydrology, hydraulic characteristics, and hydromorphology of the site, and potential impacts on the wider water environment associated with redevelopment of this area of currently vacant land in the longer term, have informed the proposed site development and mitigation proposals. Details are outlined in **Appendix 6.2** (**Volume 2**).

Table 11- 8: Summary of potential operational-phase impacts

Receptor	Chainage (ch.)	Detail of potential impact(s)	Sensitivity	Magnitude	Significance of Impact
Water Quality (Surface Water)					
N/A	N/A	No significant impacts on surface water from routine runoff identified	N/A	N/A	**N/A**
N/A	N/A	No significant impacts on surface water from accidental spillage identified.	N/A	N/A	**N/A**
Water Quality (Groundwater)					
N/A	N/A	No significant impacts on groundwater from routine runoff identified	N/A	N/A	**N/A**
N/A	N/A	No significant impacts on groundwater from accidental spillage identified.	N/A	N/A	**N/A**
Hydrology					
N/A	N/A	Existing catchments are not altered by the watercourse diversions and drainage layout of the Proposed Scheme design; therefore, no adverse impact to sensitive ecosystems and/ or social economic uses is envisaged compared to existing conditions.	N/A	N/A	**N/A**
Flood Risk					
Residential properties in Kingussie	48,950 to 50,100	The flood modelling shows that widening of the River Spey crossing (Hydro ID 152) results in significant reductions in River Spey (MW9.1) water levels (29mm to 112mm) for five residential properties immediately upstream of the crossing in Kingussie. One residential property is removed from the functional floodplain.	Very High	Minor Beneficial to Major Beneficial	**Large Beneficial to Very Large Beneficial**
Non-residential properties in Kingussie	48,950 to 50,100	The flood modelling shows that widening of the River Spey crossing (Hydro ID 152) results in significant reductions in River Spey (MW9.1) water levels (36 to 112mm) for eight non-residential receptors immediately upstream of the crossing.	Very High	Minor Beneficial to Major Beneficial	**Large Beneficial to Very Large Beneficial**
Road (B970)	49,250	A reduction of 39mm is predicted on the B970 Ruthven Road at Kingussie, due to the effect of the crossing opening (Hydro ID 152) over the River Spey (MW9.1).	Very High	Minor Beneficial	**Large Beneficial**
Property access in Kingussie	50,300	The area of Manse Road and the railway underpass in Kingussie sees a decrease in River Spey (MW9.1) flood levels of 117mm.	Very High	Major Beneficial	**Very Large Beneficial**
Utilities in Kingussie	50,300	Flood levels of the River Spey (MW9.1) at the Waste Water Treatment Works in Kingussie are predicted to decrease by 117mm due the widening of the Spey crossing.	Very High	Major Beneficial	**Very Large Beneficial**

Receptor	Chainage (ch.)	Detail of potential impact(s)	Sensitivity	Magnitude	Significance of Impact
A9	ch.52,390 to ch.52,650	Upstream of watercourse crossing ID 159 the proposed widening of the A9 mainline to the north results in the removal of a ridge of high ground that in the existing case meant that overland flow from the watercourse (W9.27) could not reach the road. Its removal presents a material increase in the flood risk to the Proposed Scheme mainline.	High	Minor Adverse	**Slight Adverse**
Residential properties at Lynchat	52,800 to 53,400	The flood modelling demonstrates a10mm increase in flood levels from Raitts Burn (MW9.14) at Balavil West Lodge due to loss of flood storage and partially raised access track to SuDS 534.	Very High	Minor Adverse	**Large Adverse**
Non-residential property at the Highland Wildlife Park	55,400	The flood modelling shows a reduction in flood levels of 51mm at one non-residential property in the Highland Wildlife Park area due to upsizing of Hydro ID 168 (Unnamed watercourse (W9.39) and 1 receptor is no longer flooded.	Very High	Moderate Beneficial	**Very Large Beneficial**
Hydromorphology[3]					
Allt Torr an Daimh (MW9.2/ Hydro ID 138_2)	42,100	Watercourse realignment Loss of natural bed and bank, more uniform form, and change in flow patterns and sediment supply. An adverse impact is predicted as due to the natural channel being replaced by one more uniform. Culvert Increased length of fixed channel position, a loss of natural bed and banks, and a change in downstream sediment continuity due to increase unnatural bed. Therefore, an adverse impact is predicted as due to the new culvert fixing the channel position and creating artificial bed and banks.	Medium	Minor Adverse	**Slight Adverse**
Unnamed watercourse (W9.5/ Hydro ID 140)	43,550	Watercourse realignment (2No.) Loss of natural bed and bank, more uniform form, and change in flow patterns and sediment supply results in a predicted adverse impact.	Medium	Minor Adverse	**Slight Adverse**
Allt Eoghainn (MW9.4/ Hydro ID 145)	45,700	Watercourse realignment Loss of natural bed and bank, more uniform form, and change in flow patterns and sediment supply results in a predicted adverse impact.	Medium	Moderate Adverse	**Moderate Adverse**
Unnamed watercourse (W9.11/ Hydro ID 146_1)	46,050	Watercourse realignment (2No.) Loss of natural bed and bank, more uniform form, and change in flow patterns and sediment supply results in a predicted adverse impact.	Medium	Minor Adverse	**Slight Adverse**
Milton Burn/ Inverton Burn (MW 9.6/ Hydro ID 147)	47,350	Bridge Loss of natural bed and banks, more uniform form, change in flow patterns and sediment supply, and increased length of fixed channel position results in a predicted adverse impact.	High	Minor Adverse	**Slight Adverse**

[3] Multiple engineering activities may be undertaken on individual watercourses. Where this occurs, each activity is assessed separately and a significance of impact determined. Details of each engineering activity and associated significance are reported in **Appendix 11.4** (and Annexes); however, only the highest impact significance (adverse or beneficial) is included in **Table 11- 8**.

Receptor	Chainage (ch.)	Detail of potential impact(s)	Sensitivity	Magnitude	Significance of Impact
River Spey (MW 9.1/ hydro ID 152)	50,150	New crossing Improved flow and sediment transport conditions upstream and downstream of crossing. Reduced fixing of the channel position through partial removal of embankment and piers.	Very High	Major Beneficial	**Large Beneficial**
Unnamed watercourse (MW 9.11/ Hydro ID 155)	51,250	Watercourse realignment (2No.) Loss of natural bed and bank, more uniform form, and change in flow patterns and sediment supply results in a predicted adverse impact. New crossing (2No.) Increased length of fixed channel position, a reduction in downstream flow and sediment transport, loss of natural bed and banks, and change in flow patterns and sediment supply.	Medium	Minor Adverse	**Slight Adverse**
Allt Cealgach (MW 9.12/ Hydro ID 157)	51,720	Watercourse realignment (2No.) Loss of natural bed and bank, more uniform form, potential for increased deposition and change in flow patterns and sediment supply results in a predicted adverse impact.	High	Minor Adverse	**Slight Adverse**
Unnamed watercourse (W9.27/ Hydro ID 159)	52,650	Watercourse realignment (3No.) Loss of natural bed and bank, more uniform form, potential for increased deposition and change in flow patterns and sediment supply results in a predicted adverse impact. New crossing Increased length of fixed channel position, a reduction in downstream flow and sediment transport, loss of natural bed and banks, and change in flow patterns and sediment supply.	Medium	Minor Adverse	**Slight Adverse**
Unnamed watercourse (W9.30/ Hydro ID 161)	52,900	Watercourse realignment (2No.) Loss of natural bed and bank, more uniform form, potential for increased deposition and change in flow patterns and sediment supply results in a predicted adverse impact.	Medium	Minor Adverse	**Slight Adverse**

11.5 Mitigation

Standard, Embedded and Additional Mitigation

11.5.1 'Standard' mitigation measures 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 11-9**.

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 11-10** 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 comprises additional measures identified as part of this assessment and which apply specifically to Road Drainage and the Water Environment affected by the Proposed Scheme. These are listed in **Table 11-11**.

11.5.4 The location of mitigation items (embedded and additional) is provided in **Drawings 11.26** to **11.37 (Volume 3)**. During later stages of design development, alternative mitigation measures may be employed subject to appropriate assessment and agreement with the concerned authorities (e.g. SEPA).

11.5.5 The 'Timing of Measure' provided in **Tables 11-9** to **11-11** refers to the *implementation of the mitigation measure*. This could mean that implementation of the measure requires further development during contractor design and construction, e.g. to work up detailed design and method statements to install an underpass or an outfall, and then implement during construction.

Compensatory Flood Storage Areas

11.5.6 Provision of compensatory storage areas (CSAs) to offset loss of functional floodplain is recognised as good practice complying with Scottish Planning Policy and SEPA guidance; however, during the DMRB Stage 3 environmental assessment process it was evident that other environmental attributes may be adversely affected by the excavation of land required to provide some storage areas. Details of this assessment are presented in a 'Cross-Discipline Assessment of CSAs' in **Appendix 11.3** of **Volume 2**.

11.5.7 Where an adverse environmental impact has been identified, or where excavation of large areas of land is deemed disproportionate to the expected benefit (i.e. where hydraulic modelling has demonstrated a minimal resulting reduction in flood levels), then an alternate means of addressing a predicted increase in flood level is proposed (e.g. displacement of flood water by maintaining existing culvert capacity and mobilising upstream storage). Details of alternative mitigation proposals are presented in the Flood Risk Assessment (**Appendix 11.3** in **Volume 2**).

Table 11- 9 Standard Mitigation Commitments for Protection of the Water Environment

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 and 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 and 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 (Schedule of Environmental Commitments)) 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 (where 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 and 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; and • 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). Construction Site Licence (CSL) under CAR and the associated Pollution Prevention Plan (PPP).
SMC-W4	Throughout Proposed Scheme	Pre-Construction and 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 Construction Site Licence (CSL) under CAR and the associated Pollution Prevention Plan (PPP).

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.	Construction Site Licence (CSL) under CAR and the associated Pollution Prevention Plan (PPP).
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**) • compliance with the Pollution Incident Control Plan (refer to **Mitigation Item SMC-S1** in **Table 21-1**).	To avoid spillages and reduce impacts on the water environment in relation to refuelling.	Construction Site Licence (CSL) under CAR and the associated Pollution Prevention Plan (PPP).
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 SMC-S1** in **Table 21-1**) • construction activities will comply with the Pollution Incident Control Plan (refer to **Mitigation Item SMC-S1** in **Table 21-1**)	To reduce impacts on the water environment in relation to oil/ fuel leaks and spillages.	Construction Site Licence (CSL) under CAR and the associated Pollution Prevention Plan (PPP).
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.	Construction Site Licence (CSL) under CAR and the associated Pollution Prevention Plan (PPP).

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. Construction Site Licence (CSL) under CAR and the associated Pollution Prevention Plan (PPP).
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 'GPP04 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 Construction Site Licence (CSL) under CAR and the associated Pollution Prevention Plan (PPP).
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	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
			• provide a temporary alternative water supply (e.g. bottled or tankered) if services are to be disrupted or diverted by the works.		
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 Table 21-5	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 and approval of 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 and approval of 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 and approval of SEPA
SMC-W16	Throughout Proposed Scheme	Design and 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 realignment outfalls; and/ or; increased sinuosity ➢ a decrease in gradient within the channel will require mitigation in the form of the 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.	To reduce impacts of channel realignment on the water environment.	Consultation with and approval of SEPA

Mitigation Item	Approximate Chainage/ Location	Timing of Measure	Description	Mitigation Purpose/ Objective	Specific Consultation or Approval Required
SMC-W17	Throughout Proposed Scheme	Design and 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), 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- 10 Project-Specific Embedded Mitigation Commitments for Protection of the Water Environment

Mitigation Item	Approximate Chainage/ Location	Timing of Measure	Description	Mitigation Purpose/ Objective	Specific Consultation or Approval Required
Embedded Mitigation					
P09-W1	ch. 50,700/ southbound side of A9	Design and Construction	**SuDS basin*** Dry detention basins shall be sized to attenuate and store extreme flood events and restrict outflow to 'greenfield' runoff rates and provide long-term storage (i.e. the difference between the predicted development runoff volume and the estimated greenfield volume) until floodwaters have abated. 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 and/ or to provide permanently wetted areas required for ecological enhancement (*Or equivalent SuDS measure agreed through consultation with regulatory authorities. Any changes made to the design by the Contractor must still comply with the residual effects determined through the EIA process (i.e. be no worse than the Proposed Scheme).	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
P09-W1a	Multiple discrete locations throughout Proposed Scheme – 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	SEPA consultation/ approval; CAR authorisation; CNPA consultation
P09-W2	ch. 41,750/ northbound side of A9 ch. 43,400/ northbound side of A9 ch. 45,800/ northbound side of A9 ch. 46,100/ northbound side of A9 ch. 47,450/ northbound side of A9 ch. 48,700/ northbound side of A9 ch. 49,000/ northbound side of A9 ch. 49,300/ southbound side of A9 ch. 53,400/ southbound side of A9 ch. 53,700/ southbound side of A9	Design and Construction	**SuDS basin*** As per P09-W1 with inclusion of a micro-pool (i.e. 'a pool at the outlet that is permanently wet and improves the pollutant removal system. The ecological value of the system can also be enhanced by including micro-pools or wetland zones at the base' (CIRIA, 2015)) (*Or equivalent SuDS measure agreed through consultation with regulatory authorities. Any changes made to the design by the Contractor must still comply with the residual effects determined through the EIA process (i.e. be no worse than the Proposed Scheme).	Providing additional/ enhanced treatment where required to meet water quality thresholds. Where SuDS encroach into sensitive habitat, provision of micro-pool mitigates potential impact by providing compensatory habitat	SEPA consultation/ approval; CAR authorisation; CNPA consultation

Mitigation Item	Approximate Chainage/ Location	Timing of Measure	Description	Mitigation Purpose/ Objective	Specific Consultation or Approval Required
P09-W3	ch. 42,700/ southbound side of A9 ch. 50,900/ southbound side of A9 ch. 51,300/ southbound side of A9 ch. 53,000/ southbound side of A9	Design and Construction	**SuDS pond*** Wet retention ponds shall be sized to attenuate and store extreme flood events and restrict outflow to 'greenfield' runoff rates and provide long-term storage. 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 and/ or to provide permanently wetted areas required for ecological enhancement. (*Or equivalent SuDS measure agreed through consultation with regulatory authorities. Any changes made to the design by the Contractor must still comply with the residual effects determined through the EIA process (i.e. be no worse than the Proposed Scheme).	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.	SEPA consultation/ approval; CAR authorisation; CNPA consultation
P09-W4	ch. 50,200/ northbound and southbound side of A9	Design and Construction	**Swale*** Swale sized to attenuate road runoff and provide second stage of treatment. Spillage containment features shall be included in SuDS facilities (emergency shut-off valve chambers at the outlet); SuDS are to be lined to prevent adverse impacts to groundwater and/ or to provide permanently wetted areas required for ecological enhancement. (*Or equivalent SuDS measure agreed through consultation with regulatory authorities. Any changes made to the design by the Contractor must still comply with the residual effects determined through the EIA process (i.e. be no worse than the Proposed Scheme).	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.	SEPA consultation/ approval; CAR authorisation; CNPA consultation
P09-W5	ch. 56,150/ southbound side of A9 ch. 56,300/ southbound side 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 WAT-RM-08 and the SuDS Manual). Spillage containment features shall be included in SuDS facilities (emergency shut-off valve chambers at the outlet). (*Or equivalent SuDS measure agreed through consultation with regulatory authorities. Any changes made to the design by the Contractor must still comply with the residual effects determined through the EIA process (i.e. be no worse than the Proposed Scheme).	Providing additional/ enhanced treatment where required to meet water quality thresholds.	SEPA consultation/ approval; CAR authorisation

Mitigation Item	Approximate Chainage/ Location	Timing of Measure	Description	Mitigation Purpose/ Objective	Specific Consultation or Approval Required
P09-W6	ch. 45,950 to 46,000/ upstream of Hydro ID 146 ch. 45,900 to 46,100/ downstream of Hydro ID 145 ch. 50,650 to 50,700/ 125m east of A9 mainline ch. 53,050 to 53,150/ 120m west of Chapelpark ch. 53,200 to 53,450/ upstream of Hydro ID 162 ch. 55,200 to 55,250/ upstream of Hydro ID 166	Design and Construction	**Compensatory storage areas** Size compensatory flood storage to compensate for loss of 200yr functional floodplain. (Final refinement of the road design after the conclusion of DMRB Stage 3 will dictate the exact volumes required and the level breakdown of the provision. Full details shall be provided to SEPA to demonstrate that full like-for-like storage (or the alternative expected) is being provided as has been set out as a requirement in the FRA.)	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 and THC to be consulted specifically on flood risk on the final detailed design prior to construction.*. (Final refinement of the road design after the conclusion of DMRB Stage 3 will dictate the exact volumes required and the level breakdown of the provision. Full details shall be provided to SEPA to demonstrate that full like-for-like storage (or the alternative expected) is being provided as has been set out as a requirement in the FRA.)
P09-W7	All watercourse diversions throughout the Project 9 Proposed Scheme extent	Design and Construction	**Watercourse diversions** Inclusion of a low flow channel (designed for a 1:2year flow).	Restoration of channels to more natural river morphology facilitating natural channel processes and encouraging sediment transfer through the catchment	CAR authorisation
P09-W8a	ch. 40,450/ Hydro ID 134 ch. 46,050/ Hydro ID 146 ch. 48,350/ Hydro ID 149 ch. 52,600/ Hydro ID 159 ch. 55,250/ Hydro ID 166 ch. 55,600/ Hydro ID 168	Design and Construction	**Culverts** Adopting a shorter length of culvert where possible	A shorter culvert length will reduce problems associated with blockage, as well as providing ecological benefits as fish will migrate through a short culvert (but be discouraged by a long culvert)	SEPA consultation/ approval/ CAR authorisation
P09-W8b	ch. 51,200/ downstream of Hydro ID 155	Design and Construction	**Watercourse Diversion** Extended channel to a point downstream of the receptors (properties, B-road) to provide a full 200yr capacity until it ties in with the existing channel.	Avoids directing more water towards residential and non-residential receptors' This regrading of the channel reduces flood risk to the receptors relative to the existing case.	SEPA and THC to be consulted specifically on flood risk on the final detailed design prior to construction.*

Mitigation Item	Approximate Chainage/ Location	Timing of Measure	Description	Mitigation Purpose/ Objective	Specific Consultation or Approval Required
P09-W8c	ch. 51,250/ upstream of Hydro ID 155	Design and Construction	**Drainage channel/ ditch** Drainage channel/ ditch provided upstream of track to intercept and divert overland flow away from the track and return it to the channel at the inlet to the culvert.	Reduce overland flow flood risk to access track upstream of watercourse Hydro ID155.	SEPA and THC to be consulted specifically on flood risk on the final detailed design prior to construction. Where the detailed final design deviates from the outline designs on which this ES is based, further flood risk assessment may be required to ensure the effect on flood risk remains neutral.

Table 11- 11 Project-Specific 'Additional' Mitigation Commitments for Protection of the Water Environment

Mitigation Item	Chainage/ Approximate Location	Timing of Measure	Description	Mitigation Purpose/ Objective	Specific Consultation or Approval Required
Project-Specific Mitigation					
P09-W9	All culverts throughout Proposed Scheme	Design and Construction	**Culverts** Inclusion of a low flow channel through the crossing; incorporate an erodible bed through culvert; add scour pool downstream of culvert to dissipate energy; add suitable grade, size, shape and geology of material to culvert bed; increase the roughness of all culvert inverts to help reduce water velocities and keep bed material in the culverts using baffles or embedded cobbles.	To dissipate energy and reduce risk of erosion in line with current standards. Encouraging sediment transfer through the catchment	SEPA consultation/ approval; CAR authorisation
P09-W10	All structures throughout Proposed Scheme	Design and Construction	**Structures** Where possible, bridge abutments should be set back from the top of the river banks to limit the requirement for erosion and scour protection. Low flow channels should be maintained or created.	To allow natural migration/ evolution of river morphology, allow natural channel migration and encourage sediment transfer through the catchment without compromising structural integrity , low flow channels to maintain minimum water depth	SEPA consultation/ approval; CAR authorisation
P09-W11	All culverts throughout Proposed Scheme	Design and Construction	**Channel restoration** Remove the existing hard engineering associated with the existing A9 channels where feasible, within the extents of the Proposed Scheme and replace with varied bank profiles and bed forms, and a natural bed, of a river type suitable for the channel setting.	Restoration to more natural river morphology facilitating natural channel migration and encouraging sediment transfer through the catchment	SEPA consultation/ approval; CAR authorisation

Mitigation Item	Chainage/ Approximate Location	Timing of Measure	Description	Mitigation Purpose/ Objective	Specific Consultation or Approval Required
P09-W12	All watercourse diversions throughout Proposed Scheme	Design and Construction	**Watercourse diversions** Re-create natural planforms with low flow channels, and ensure a suitable channel typology for the setting with varied bed and bank morphology suitable for the channel gradient and type; and use suitable size, shape, geology and grade of substrate material for channel conditions; If erosion protection is deemed necessary at detailed design stage use green bank protection works where feasible. Backfill channels after they have been diverted where this does not compromise land-drainage, to reduce the risk of high flows entering the old channels and causing scour.	Restoration to more natural river morphology facilitating natural channel migration and encouraging sediment transfer through the catchment.	SEPA consultation/ approval; CAR authorisation
P09-W13	All structures throughout Proposed Scheme	Design and Construction	**Outfall headwalls** Minimise the size/ extent of hard engineering and use green engineering to reduce potential impact on the bed and banks. Direct flow from outfalls downstream to minimise impacts to flow patterns and to reduce the risk of erosion (to the outfall structure and channel bank). Design outfalls (SuDS and drains) to take into account potential future changes in bank and bed position of the receiving channel (to minimise potential impact to engineering works and to allow channel to migrate across floodplain).	Reduce risk of erosion in line with current standards.	SEPA consultation/ approval; CAR authorisation
P09-W14	ch.47,300/ downstream of Hydro ID 147	Design and Construction	**Access Track** Realign the access track to Inverton cottage to reduce volume of the encroachment. The crossing will be sized to achieve a neutral or better effect on downstream flood risk.	Significantly reduce volume of encroachment by removing access track from floodplain	SEPA and THC to be consulted specifically on flood risk on the final detailed design prior to construction. Where the final design deviates from the outline designs on which this ES is based, further flood risk assessment may be required to ensure the effect on flood risk remains neutral.

Mitigation Item	Chainage/ Approximate Location	Timing of Measure	Description	Mitigation Purpose/ Objective	Specific Consultation or Approval Required
P09-W15	ch.50,250/ SuDS basin 493	Design and Construction	**SuDS** Subject to agreement with SEPA and THC, reduce standard of protection for SuDS basins to minimise encroachment.	Reduce volume of encroachment into floodplain	SEPA and THC to be consulted specifically on flood risk on the final detailed design prior to construction. Where the final design deviates from the outline designs on which this ES is based, further flood risk assessment may be required to ensure the effect on flood risk remains neutral.
P09-W16	ch. 53,400/ downstream of Hydro ID 162	Design and Construction	**Access track** Lower access track to SuDS basin 534 as far as possible along its full length to mitigate or reduce impacts relating to the changes in flow patterns.	Reduce volume of encroachment by removing access track from floodplain	SEPA and THC consultation/ approval
P09-W17	ch. 52,650/ upstream of Hydro ID 159	Design and Construction	**Drainage channel** A channel sized to accommodate the 200yr flow in the upstream watercourse will be provided along the top of the cut slope until it reaches the higher ground to the west.	Mitigate effects of the removal of a ridge of high ground that prevents overland flow from the watercourse reaching the road.	SEPA and THC consultation/ approval
P09-W18	ch.51,200/ downstream of Hydro ID 155	Design	**Watercourse Diversion** The channel capacity downstream of crossing ID 155 will be increased to mitigate the impact to the non-residential receptor.	Mitigate the impact to the non-residential receptor and minimise likelihood of the channel flowing out of bank at any location along its length in the 200 year event.	SEPA and THC to be consulted specifically on flood risk on the final detailed design prior to construction. Where the final design deviates from the outline designs on which this ES is based, further flood risk assessment may be required to ensure the effect on flood risk remains neutral.

Mitigation Item	Chainage/ Approximate Location	Timing of Measure	Description	Mitigation Purpose/ Objective	Specific Consultation or Approval Required
P09-W19	ch. 40,450/ Hydro ID 134 ch. 40,760/ Hydro ID 136 ch. 44,160/ Hydro ID 143 ch. 44,375/ Hydro ID144 ch. 46,040/ Hydro ID 146 ch. 48,040/ Hydro ID 148 ch. 51,710/ Hydro ID 157 ch. 52,600/ Hydro ID 159 ch. 55,270/ Hydro ID 166 ch. 52,650/ 159 – Access Track 1 ch. 55,600/ 168 – Access Track 2	Design and Construction	**Culverts** Baffles or embedded cobbles or similar will be provided on steeper channel crossings.	To increase the roughness of culvert inverts and help reduce water velocities, dissipate energy, reduce downstream scour, and keep bed material in the culverts.	SEPA consultation/ approval; CAR authorisation
P09-W20	ch.51,200/ upstream of Hydro ID 155	Design	**Watercourse Diversion** Extend upstream interception channel to the west to mitigate the remaining inundation of the access track.	Mitigate the remaining inundation of the access track.	SEPA and THC to be consulted specifically on flood risk on the final detailed design prior to construction. Where the final design deviates from the outline designs on which this ES is based, further flood risk assessment may be required to ensure the effect on flood risk remains neutral.
P09-W21	ch.56,200/ Hydro ID 170	Design	**Structure Headwall** The headwall on the upstream and downstream side of the crossing will be extended to reduce or fully remove the encroachment.	Fully remove the encroachment from functional floodplain.	SEPA and THC to be consulted specifically on flood risk on the final detailed design prior to construction. Where the final design deviates from the outline designs on which this ES is based, further flood risk assessment may be required to ensure the effect on flood risk remains neutral.

Mitigation Item	Chainage/ Approximate Location	Timing of Measure	Description	Mitigation Purpose/ Objective	Specific Consultation or Approval Required
P09-W22	Throughout the Project 9 Proposed Scheme extent	Design	**SuDS** Alternate SuDS measures (e.g. swale/ grassed channel) should be considered where HAWRAT results are marginal (i.e. Networks 531 and 537) to optimise treatment efficiency.	Optimise SuDS treatment in spatially constrained area utilising latest information available from Ground Investigation	SEPA consultation/ approval
P09-W23	Throughout the Project 9 Proposed Scheme extent	Operation	**Maintenance** Risk of blockage of watercourse crossings/ structures will be reduced by regular inspection and maintenance.	Minimise potential flood risk to the Proposed Scheme	SEPA and THC to be consulted specifically on flood risk on the final detailed design prior to construction. Where the final design deviates from the outline designs on which this ES is based, further flood risk assessment may be required to ensure the effect on flood risk remains neutral.

11.6 Residual Impacts

11.6.1 Following implementation of the additional specific mitigation outlined in **section 11.5**, potential impacts on the water environment will be avoided/ prevented, reduced or offset. 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. Remaining residual impacts that are not of Neutral significance are presented in **Table 11- 12**.

11.6.2 Recommendations for periodic monitoring as part of a routine operational maintenance and inspection regime are also reported where relevant in the appropriate appendices. The purpose of monitoring (in line with EIA Directive) is to provide feedback on the effectiveness of mitigation measures on any significant (adverse) impacts on the environment resulting from the construction and operation of the Proposed Scheme. Monitoring will also identify unforeseen significant adverse impacts in order to undertake appropriate remedial action.

Water Quality (Surface Water)

11.6.3 As the existing drainage system considerably predates the employment of SuDS techniques (and any treatment currently provided is at best incidental and does not meet the requirements of current standards) there is no facility anywhere on the existing drainage system to intercept and contain accidental spillages of oil or other contaminants. Therefore, an overall improvement in water quality is predicted compared with the baseline condition due to the first-time application of SuDS resulting in a residual **Slight Beneficial** impact.

Water Quality (Groundwater)

11.6.4 Appropriate embedded mitigation (e.g. lining SuDS to prevent dispersal of potentially polluted road runoff to ground), has been incorporated into the design, therefore, groundwater quality will not be adversely impacted as a result of routine runoff or accidental spillage. Furthermore, the risk of accidental spillage is significantly below the threshold set by HD45/09. An overall improvement in water quality is predicted compared with the baseline condition due to the first-time application of SuDS resulting in a residual **Slight Beneficial** impact. Further details are provided in **Appendix 11.2** (**Volume 2**).

Hydrology

11.6.5 Existing catchments are not altered by the watercourse diversions and drainage layout of the Proposed Scheme design; therefore, no adverse impact to sensitive ecosystems and/ or social economic uses is envisaged.

Flood Risk

11.6.6 The inclusion of SuDS in the Proposed Scheme design provides attenuation to 'greenfield' runoff rates across the Proposed Scheme extent; and despite the dual (additional) carriageway increasing potential surface runoff, the absence of attenuation facilities on existing A9 drainage means the Proposed Scheme will result in an overall improvement on the water environment resulting in a residual **Slight Beneficial** impact.

11.6.7 The flood modelling results indicate that several sensitive receptors throughout the Proposed Scheme extent will flood in existing conditions (e.g. upstream of the Spey crossing in the Kingussie 'PVA', downstream of the crossing in and around Insh Marshes, the B9152, and the Highland Wildlife Park).

11.6.8 The Proposed Scheme reduces flood risk to receptors around Kingussie upstream of the existing A9 River Spey Bridge due to the reduced embankment length (increased opening) to avoid encroachment in SAC and improve channel morphology. Removal of this flow restriction results in a negligible increase in flood levels experienced in and around Insh Marshes as a result of the lost storage upstream of the embankment.

11.6.9 Inclusion of 'additional mitigation' to the Proposed Scheme removes or reduces residual flood risk; therefore, the overall significance of residual impacts for flood risk ranges from **Neutral** to **Very Large Beneficial**. For further detail see **Appendix 11.3** in **Volume 2**; a summary is provided in **Table 11- 12** below.

Hydromorphology

11.6.10 Implementation of additional mitigation will create more natural river morphology throughout the Proposed Scheme extent. It will facilitate natural channel migration and encourage sediment transfer through catchments resulting in **Slight** to **Moderate Beneficial** residual impacts on the hydromorphology of the water environment.

11.6.11 A longer span at the River Spey Bridge (Hydro ID 152) increasing channel-floodplain connectivity and natural flow conditions in this reach of the river will result in an overall **Large Beneficial** residual impact. For further detail see **Appendix 11.4** in **Volume 2**; a summary is provided in **Table 11- 12** below.

Table 11- 12 Predicted residual impacts on the water environment

Receptor	Chainage (ch.)	Sensitivity	Significance of impact	Mitigation	Summary of Residual Impacts	Magnitude of Residual Impact	Significance of Residual Impact
Water Quality							
Multiple watercourses and extensive areas of groundwater	Throughout the Proposed Scheme extent	Low to High	Slight Beneficial	Provision of SuDS for treatment of routine road runoff and spillage containment for protection of surface and groundwater	SuDS will reduce contamination and pollution risk commonly associated with road runoff and accidental spillage and provide a beneficial impact on the water environment (surface and groundwater) comparative to exiting conditions as the current A9 has limited or no road drainage treatment	Minor Beneficial	**Slight Beneficial**
Flood Risk							
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 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**
Residential properties in Kingussie	48,950 to 50,100	Very High	Large Beneficial to Very Large Beneficial	None	The flood modelling shows that extending the span of the River Spey Bridge (Hydro ID 152) results in significant reductions in River Spey (MW9.1) water levels (29mm to 112mm) for five residential properties immediately upstream of the crossing in Kingussie. One residential property is removed from the functional floodplain.	Minor Beneficial to Major Beneficial	**Large Beneficial to Very Large Beneficial**
Non-residential properties in Kingussie	48,950 to 50,100	Very High	Large Beneficial to Very Large Beneficial	None	Results in significant reductions in River Spey (MW9.1) Spey water levels (36 to 112mm) for eight non-residential receptors immediately upstream of the crossing (Hydro ID 152)	Minor Beneficial to Major Beneficial	**Large Beneficial to Very Large Beneficial**
Road (B970)	49,250	Very High	Large Beneficial	None	A reduction of 39mm in River Spey (MW9.1) is predicted on the B970 Ruthven Road at Kingussie due to the effect of the Spey crossing opening (Hydro ID 152).	Minor Beneficial	**Large Beneficial**

Receptor	Chainage (ch.)	Sensitivity	Significance of impact	Mitigation	Summary of Residual Impacts	Magnitude of Residual Impact	Significance of Residual Impact
Property access in Kingussie	50,300	Very High	Very Large Beneficial	None	The area of Manse Road and the railway underpass in Kingussie sees a decrease in flood levels of 117mm in the River Spey (MW9.1) due to the effect of the Spey crossing opening (Hydro ID 152).	Major Beneficial	**Very Large Beneficial**
Utilities in Kingussie	50,300	Very High	Very Large Beneficial	None	Flood levels from the River Spey (MW9.1) at the Waste Water Treatment Works in Kingussie are predicted to decrease by 117mm due to the effect of the Spey crossing opening (Hydro ID 152).	Major Beneficial	**Very Large Beneficial**
A9	ch.52,390 to ch.52,650	High	Slight Adverse	A channel sized to accommodate the 200yr flow in the upstream watercourse will be provided along the top of the cut slope until it reaches the higher ground to the west.	Inclusion of proposed mitigation removes the material increase in flood risk to the Proposed Scheme mainline road.	Negligible	**Neutral**
Residential properties at Lynchat	52,800 to 53,400	Very High	Large Adverse	Lower access track to SuDS basin 534 as far as possible along its full length to mitigate or reduce impacts relating to the changes in flow patterns.	Avoids directing overland flood water towards the road and increasing flood water depths.	Negligible	**Neutral**
Non-residential property at the Highland Wildlife Park	55,400	Very High	Very Large Beneficial	Upsizing of Hydro ID 168 (Unnamed watercourse W9.39)	The flood modelling shows a reduction in flood levels of 51mm at one non-residential property in the vicinity of the Highland Wildlife Park	Moderate Beneficial	**Very Large Beneficial**
Hydromorphology							
Allt Torr an Daimh (MW9.2/ Hydro ID 138_2)	42,100	Medium	Slight Adverse	Incorporation of a low flow channel (designed for a 1:2 year flow) through the crossing; erodible bed through culvert; suitable grade of bed material to new culvert; and scour pool downstream of culvert to dissipate energy	Implementation of additional mitigation will create more natural river morphology. It will facilitate natural channel migration and encourage sediment transfer through the catchment resulting in beneficial impacts on the hydromorphology of the water environment	Minor Beneficial	**Slight Beneficial**
Unnamed watercourse (W9.5/ Hydro ID 140)	43,550	Medium	Slight Adverse	Upsized culvert, change in culvert type and addition of bed material within the culvert	Naturalised flow and improved continuity of sediment transfer due to upsized culvert and addition of bed material	Minor Beneficial	**Slight Beneficial**

Receptor	Chainage (ch.)	Sensitivity	Significance of impact	Mitigation	Summary of Residual Impacts	Magnitude of Residual Impact	Significance of Residual Impact
Allt Eoghainn (MW9.4/ Hydro ID 145)	45,650	Medium	Slight Adverse	Improved planform of low flow channel; addition of varied bed and bank morphology suitable for the channel gradient and type; incorporation of suitable size and grade of substrate for channel conditions; a low flow channel (designed for a 1:2 year flow) through the crossing; and inclusion of scour pool downstream of culvert to dissipate energy	Implementation of additional mitigation will create more natural river morphology. It will facilitate natural channel migration and encourage sediment transfer through the catchment resulting in beneficial impacts on the hydromorphology of the water environment	Moderate Beneficial	**Moderate Beneficial**
Unnamed watercourse (W9.11/ Hydro ID 146_1)	46,000	Medium	Slight Adverse	Improved planform of low flow channel; addition of varied bed and bank morphology suitable for the channel gradient and type; incorporation of suitable size and grade of substrate for channel conditions; a low flow channel (designed for a 1:2 year flow) through the crossing; and inclusion of scour pool downstream of culvert to dissipate energy	More natural flows downstream will facilitate natural channel migration and encourage sediment transfer through the catchment resulting in beneficial impacts on the hydromorphology of the water environment	Moderate Beneficial	**Moderate Beneficial**
Milton Burn/ Inverton Burn (MW 9.6/ Hydro ID 147)	47,350	High	Slight Adverse	Bridge with embankment set well back from the channel; inclusion of a low flow channel (designed for a 1:2 year flow); suitable grade of bed material to new culvert; and incorporate scour pool downstream of culvert to dissipate energy	Implementation of additional mitigation will create more natural river morphology. It will facilitate natural channel migration and encourage sediment transfer through the catchment resulting in beneficial impacts on the hydromorphology of the water environment	Negligible	**Neutral**
River Spey (MW 9.1/ Hydro ID 152)	50,150	Very High	Large Beneficial	None	Increasing channel-floodplain connectivity and natural flow conditions in this reach of the river	Moderate Beneficial	**Large Beneficial**

Receptor	Chainage (ch.)	Sensitivity	Significance of impact	Mitigation	Summary of Residual Impacts	Magnitude of Residual Impact	Significance of Residual Impact
Unnamed watercourse (MW 9.11/ Hydro ID 155)	51,250	Medium	Slight Adverse	Improved planform of low flow channel; addition of varied bed and bank morphology suitable for the channel gradient and type; incorporation of suitable size and grade of substrate for channel conditions; a low flow channel (designed for a 1:2 year flow) through the crossing; and inclusion of scour pool downstream of culvert to dissipate energy	Implementation of additional mitigation will create more natural river morphology. It will facilitate daylighting of the channel, encourage natural channel migration and sediment transfer through the catchment resulting in beneficial impacts on the hydromorphology of the water environment	Minor Beneficial	**Slight Beneficial**
Allt Cealgach (MW 9.12/ Hydro ID 157)	51,700	High	Slight Adverse	Improved planform of low flow channel; addition of varied bed and bank morphology suitable for the channel gradient and type; incorporation of suitable size and grade of substrate for channel conditions; a low flow channel (designed for a 1:2 year flow) through the crossing; and inclusion of scour pool downstream of culvert to dissipate energy	Increased discharge at high flows and more natural downstream sediment transfer will facilitate natural channel migration and encourage sediment transfer through the catchment resulting in beneficial impacts on the hydromorphology of the water environment	Minor Beneficial	**Slight Beneficial**
Unnamed watercourse (W9.27/ Hydro ID 159)	52,600	Medium	Slight Adverse	Improved planform of low flow channel; addition of varied bed and bank morphology suitable for the channel gradient and type; incorporation of suitable size and grade of substrate for channel conditions; a low flow channel (designed for a 1:2 year flow) through the crossing; and inclusion of scour pool downstream of culvert to dissipate energy	Implementation of additional mitigation will create more natural river morphology. It will facilitate natural channel migration and encourage sediment transfer through the catchment resulting in beneficial impacts on the hydromorphology of the water environment	Minor Beneficial	**Slight Beneficial**

Receptor	Chainage (ch.)	Sensitivity	Significance of impact	Mitigation	Summary of Residual Impacts	Magnitude of Residual Impact	Significance of Residual Impact
Unnamed watercourse (W9.30/ Hydro ID 161)	52,890	Medium	Slight Adverse	Improved planform of low flow channel; addition of varied bed and bank morphology suitable for the channel gradient and type; incorporation of suitable size and grade of substrate for channel conditions; a low flow channel (designed for a 1:2 year flow) through the crossing; and inclusion of scour pool downstream of culvert to dissipate energy	Naturalised discharge at high flows and more natural downstream sediment transfer will result in beneficial impacts on the hydromorphology of the water environment	Minor Beneficial	**Slight Beneficial**

11.7 Summary of Combined Impacts

11.7.1 Combined impacts are provided in this section in order to demonstrate that there are no adverse impacts to the water environment as per DMRB HD45/09, Scottish Planning Policy and SEPA guidance. Combined 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

11.7.2 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 of a receiving watercourse (for the purpose of this report, a reach is defined as a length of watercourse between two confluences). For sediment bound pollutants, outfalls within a 100m reach have been aggregated.

11.7.3 Cumulative impact assessments have found a 'Fail' result for acute pollution (copper) at one location post-mitigation (Networks 561/ 563). Both networks comprise filter drains, tank sewer and vortex separator, and discharge to the watercourse via a swale. However, as the swale is not equal to, or greater than, the roadway length draining to it (and therefore not considered to be a fully effective stage of treatment), a precautionary approach has been taken and their treatment efficiency have not been included in the overall assessment. Proprietary SuDS, such as vortex separators, are acceptable as an equivalent treatment component where conventional SuDS are not possible due to spatial constraints.

11.7.4 The Low sensitivity value of the receiving watercourse from both Networks 561 and 563, coupled with the Minor Adverse magnitude of impact, results in a **Neutral** significance of impact; therefore, a 'Fail' of the HAWRAT cumulative assessment does not necessitate a redesign or adoption of further mitigation in this instance. Details of the assessment are provided in **Appendix 11.2**. Overall, an improvement in water quality is predicted compared with the baseline conditions due to the first-time application of SuDS.

Hydrology and Flood Risk

11.7.5 Existing conditions and the Proposed Scheme have been hydraulically modelled. The assessment of the impacts has been extended downstream of the Proposed Scheme to Kinrara where the predicted increase in water level as a result of the Proposed Scheme is less than 1mm. Overall, this is considered to be a **Neutral** significance. Analysis at key sensitive receptors throughout the Scheme extent also found minor or negligible changes in water levels which results in a **Neutral** cumulative impact. Details of the assessment are provided in **Appendix 11.3**.

Hydromorphology

11.7.6 There will be multiple small changes to sediment transfer, discharge and velocity within the tributaries that flow into the River Spey. These have the potential to have a positive impact on 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.

11.7.7 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 the potential volume of sediment conveyed from the tributaries to the Spey, creating more 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 River Spey and its tributaries. Details of the assessment are provided in **Appendix 11.4**.

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