Co-financed by the Connecting Europe Facility of the European Union

ENVIRONMENTAL IMPACT ASSESSMENT REPORT

TEN-T Priority Route Improvement Project, Donegal

Chapter 11: Water

TT_MGT0337-RPS-P3-ZZ-RP-E-EN0001

EIAR

March 2026

Table of Contents

Tables

Figures

List of Abbreviations

The following is a list of abbreviations used within this chapter of the Environmental Impact Assessment Report (EIAR).

List of Abbreviations used in Water Chapter of this EIAR

List of Abbreviations	
ADAS	Agricultural Development and Advisory Service
AEP	Annual Exceedance Probability
AFA	Areas for Further Assessment
ARTDRAIN	Arterial Drainage Factor
BFI	Baseflow Index
BFISOIL	Baseflow Index of Soils
CFRAM	Catchment Flood Risk Assessment and Management
CIRIA	Construction Industry Research and & Information Association
FARL	Flood Attenuation from Reservoirs and Lakes
FRA	Flood Risk Assessments
FSR	Flood Studies Report
FSU	Flood Studies Update
HEWRAT	Highways England Water Risk Assessment Tool
HEC-RAS	Hydrological Engineering Centre River Analysis System
HGV	Heavy Good's Vehicle
ICPSS	Irish Coastal Protection Strategic Study
ICWWS	Irish Coastal Wave and Water Level Modelling Study
LiDAR	Light Detection and Ranging
LLO	Land Liaison Officers
NIFM	National Indicative Fluvial Mapping
PAH	Polycyclic Aromatic Hydrocarbons
PCD	Physical Catchment Descriptors
PFRA	Preliminary Flood Risk Assessment Mapping
PINC	Pollution Incident
PSPL	Probability of Spillage
PWS	Public Water Supply
SAAR	Standard Average Annual Rainfall
S-P-R	Source-Pathway-Receptor
SSRS	Small Stream Risk Assessment
SuDS	Sustainable drainage systems
UoM	Unit of Management
URBEXT	Urban Extent
WSS	Water Supply Scheme
WWTP	Wastewater Treatment Plant

11 WATER

11.1 Introduction

This chapter examines the potential impacts on the existing hydrological environment due to works during the construction and operational phases of the proposed Trans-European Transport Network Priority Route Improvement Project, Donegal (TEN-T PRIPD), hereafter, the 'Proposed Development'. The Proposed Development is divided into three sections:

- **Section 1:** N15/N13 Ballybofey / Stranorlar Urban Region
- **Section 2:** N56/N13 Letterkenny to Manorcunningham
- **Section 3:** N14 Manorcunningham to Lifford / Strabane / A5 Link

The extents of the scheme area are defined as the lands within a 250 m buffer of the land-take boundary for the Proposed Development as well as the associated upstream and downstream catchments. The scheme area makes provision for, inter alia: link roads, re-aligned side roads, accommodation tracks, re-aligned watercourses, and other related infrastructure.

11.2 Methodology

11.2.1 Competent Experts

Lead Author Section 1 and Section 2: Patrick (PJ) Griffin is a Chartered Engineer with over 30 years' experience in a wide range of water & wastewater, environmental and structural projects. He has completed preliminary and detailed design of surface water collection systems including the implementation of SuDS techniques as well as a number of flood studies and outline and detailed design for flood alleviation schemes. PJ also has extensive experience in wastewater treatment plant upgrades, pumping station and collection systems design and construction. He has also performed hydraulic analysis of existing water networks and prepared preliminary reports, detailed design and contract documents for a number of water and waste water schemes.

PJ has been responsible for the development of a number of flood relief schemes and for the hydrological inputs and drainage design of windfarms and roads projects. PJ has also completed hydrological Impact and flood risk assessments for raised bogs, pipelines, road schemes and private developments.

Lead Author Section 3: Sean O'Leary is a qualified Civil Engineer with over 25 years of experience, working with Egis Engineering Ireland. Sean's qualifications include a National Certificate in Civil Engineering, a National Diploma in Civil Engineering and a Bachelor of Civil Engineering, BEng. Sean is a Chartered Engineer, CEng and a Member of Engineers Ireland, MIEI. Sean has extensive experience in the design and construction of road related projects. Sean specialises in Drainage and hydrology. He has worked for on feasibility studies, preliminary and detailed designs including the management of the EIAR/Environmental Reports and CPO processes and in the construction of road schemes.

11.2.2 Relevant Legislation

This chapter is prepared in accordance with the requirements of European Union Directive 2011/92/EU on the assessment of the effects of projects on the environment (the 'EIA Directive') as amended by Directive 2014/52/EU. A key objective of the amendment was to protect water resources and prevent a deterioration of water in compliance with the EU Water Framework Directive (WFD) (2000/60/EC).

The WFD requires EU member states to manage their water resources on an integrated basis to achieve at least 'good' ecological status. In Ireland this is achieved through the Water Action Plan: River Basin Management Plan (RBMP) for Ireland 2022-2027 (Department of Housing, Local Government and Heritage, 2024). The RBMP outlines all the actions required to improve the ecological status, with county councils and Uisce Éireann playing an important role in the implementation of the plan.

The following national legislation underpins the assessment:

- Planning and Development Act 2000 (as amended).
- Planning and Development Regulations 2001 (as amended).
- Water Services Act 2007 (as amended).
- Local Government (Water Pollution) (Amendment) Act, 1990 (as amended).
- Local Government (Water Pollution) Act, 1977 (as amended).
- S.I. No 296/2018: European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018 which transposes the provisions of the EIA Directive as amended by the Directive 2014/52/EU into Irish Law.
- Quality of Salmonid Waters Regulations (S.I No 293 of 1988).
- S.I. No. 477/2011 - European Communities (Birds and Natural Habitats) Regulations 2011S.I. No. 272/2009: European Communities Environmental Objectives (Surface Waters) Regulations 2009, as amended, and S.I. No. 722/2003 European Communities (Water Policy) Regulations, as amended, which implement EU Water Framework Directive (2000/60/EC)
- S.I. No. 722/2003 – European Communities (Water Policy) Regulations 2003 as amended.
- S.I. No. 489/2011 – European Communities (Technical Specifications for the Chemical Analysis and Monitoring of Water Status) Regulations, 2011.
- S.I. No. 122/2010 – European Communities (Assessment and Management of Flood Risks) Regulations 2010 as amended.
- S.I. No. 9 of 2010 - European Communities Environmental Objectives (Groundwater) Regulations 2010 as amended.

11.2.3 Relevant Guidance

The hydrological baseline study and impact assessment have been carried out in accordance with the following key guidance and established best practice:

- Guidelines on the Information to be contained in Environmental Impact Statements (EPA, 2022)
- Environmental Impact Assessment of Projects, Guidance on the preparation of the Environmental Impact Assessment Report (European Commission, 2017)
- Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes - Transport Infrastructure Ireland (previously National Road Authority) (NRA, 2008)
- PE-ENV-01201 Water Impact Assessment of Proposed National Roads – Standard (TII, 2025a)
- PE-ENV-01202 Water Impact Assessment for National Roads, Light Rail, Metro, and Rural Cycleways – Overarching Technical Document (TII, 2025b)
- WFD - Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for the Community action in the field of water policy. This relates to the improvement of water quality across Ireland including rivers and groundwater bodies
- The Planning System and Flood Risk Management, Guidelines for Planning Authorities (Department of the Environment, Heritage and Local Government and the Office of Public Works (OPW) (Department of Housing, Planning and Local Government & OPW, 2009)
- Guidelines on protection of fisheries during construction works in and adjacent to waters (Inland Fisheries Ireland, 2016)
- Guidelines for the Crossing of Watercourses during Construction of National Road Schemes, (TII, 2008)
- Construction Industry Research and Information Association, 2001. Control of Water Pollution from Construction Sites (CIRIA – C532)
- Construction Industry Research and Information Association, 2015. Environmental Good Practice on Site Guide (CIRIA – C741)

- Construction Industry Research and Information Association, 2016. Groundwater Control: Design and Practice (CIRIA – C750)
- Department of the Environment, Heritage and Local Government, Environmental Protection Agency and Geological Survey of Ireland, 1999. Groundwater Protection Schemes (DEHLG/EPA/GSI, 1999)
- Department of Housing, Planning and Local Government, August 2018. Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Effect Assessment (DHPLG, 2018)
- Environmental Protection Agency, 2013. Guidance on the Management of Contaminated Land and Groundwater at EPA Licensed Sites
- Environmental Protection Agency, 2013. Storage and Transfer of Materials for Scheduled Activities

NRA (2008) guidelines were used to conduct the current assessment which has been undertaken over a number of years to establish a robust baseline and assessment. A new Water Impact Assessment Standard PE-ENV-01201 was published by TII on 10 December 2025, after the completion of the assessment undertaken and set out in detail in this chapter. Section 1.4 of the new Standard expressly provides that where a project is well advanced in the design and planning phase such as is the case here, the new Standard shall be applied in a transitional manner, i.e., by using the new Standard as additional guidance and employing it in as much as reasonably practicable. In this regard, a review was conducted which showed the required approach under the new Water Impact Assessment Standard of December 2025 is an evolution of the NRA (2008) guidelines, following a very similar framework for identification of receptor sensitivity and assessment of significance in conjunction with the EPA (2022) guidelines. The assessment within this chapter contains all of the key information and assessment required by the new Standard.

11.2.4 Baseline Data Collection

The baseline data collection was undertaken to evaluate the existing environment along the Proposed Development taking account of the environment's character, significance, and sensitivity. The baseline data collection was also used to identify any trends or evidence of change impacting upon the existing environment.

11.2.4.1 Desktop Assessment of Receiving Environment

The desktop assessment consists of a review of the readily available data and research regarding the existing environment pertaining to hydrology.

The following data sources were consulted:

Donegal County Council

- County Donegal Development Plan 2024 - 2030
  - Strategic Flood Risk Assessment (SFRA, 2024), County Donegal Development Plan 2024-2030 (Donegal County Council, 2024)

Ordnance Survey Ireland (OSI)

- Discovery Series Mapping (1:50,000)
- Six Inch Raster Maps (1:10,560)
- Six inch and 25-inch OS Vector Mapping
- Orthographic Aerial Mapping

Environmental Protection Agency (EPA)

- Catchments Data Packages
- Water Quality Monitoring Database and Reports
- Hydronet System – Hydrometric Records

OPW

- Flood Risk Management Plan for the North Western River Basin 2018-2021 (Office of Public Works, 2018)
- North Western - Neagh Bann Catchment Flood Risk Assessment and Management (CFRAM) Study Unit of Management (UoM) 01 Hydrology Report (Office of Public Works, 2016)
- North Western - Neagh Bann CFRAM Study UoM 01 Hydraulics Report (RPS Group, 2017)
- North Western - Neagh Bann CFRAM Study UoM 01 Preliminary Options Report (RPS Group, 2016)
- CFRAM Predictive Fluvial & Coastal Flood Mapping
- National Indicative Fluvial Flood Mapping (NIFM, 2020)
- Preliminary Flood Risk Assessment (OPW, 2012)
- Hydro-Data – Hydrometric Records
- Arterial Drainage Schemes
- Drainage Districts
- Benefitting Areas
- Flood Studies Update (FSU) Gauged and Ungauged Catchment Physical Catchment Descriptors (PCDs)
- Irish Coastal Wave and Water Level Modelling Study 2018 (ICWWS) (RPS Group, 2020)
- Topographical and Bathymetric Survey Data (Cross-sections, Light Detection and Ranging (LiDAR) from CFRAM study) (Geographic Survey Ireland, 2021)

Geological Survey of Ireland (GSI)

- GW Flood Project - Historical Groundwater Flood Mapping (Geological Survey of Ireland, 2020a)
- GW Flood Project - Predictive Groundwater Flood Mapping (2020) (Geological Survey of Ireland, 2020b)
- GSI Spatial Resources

Other sources

- Water Action Plan 2024. A River Basin Management Plan for Ireland 2022-2027, Department of Housing, Local Government and Heritage (DHLGH, 2024).
- Marine Institute Predicted and Observed Tidal Data
- Irish Water Existing Infrastructure
- Topographical Survey
- Aerial Survey Photography and LiDAR
- National Parks and Wildlife Services (NPWS) Data
- Teagasc Subsoil Classification Map
- Chapter 9B: Biodiversity – Aquatic of this EIAR
- Minimum Specification for Farm Roadways and Underpasses (Department of Agriculture, Food and the Marine, S.199 March 2024).

11.2.4.2 Fieldwork Methodology

Extensive fieldwork was undertaken as part of the aquatic ecology biodiversity assessment (refer to Chapter 9B: Biodiversity - Aquatic) and has been used in this assessment with regard to project specific biological water quality (Q-values) and identification of water receptor sensitivity.

Fieldwork undertaken for the Flood Risk Assessment is described in Section 11.7, below.

11.2.5 Impact Assessment

This assessment identifies and describes likely significant effects of the Proposed Development based on identified sensitivity of the receptors. The sensitivities of water environment were determined using the combination of desk and baseline field studies. Levels of hydrological receptor importance are then defined using the National Road Authority (NRA) (2008) *Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes* criteria as set out in Table 11-1. Consultations with authors of EIAR Chapter 9B Biodiversity – Aquatic and Chapter 10 Land, Soils and Hydrogeology were undertaken to assist in identifying water receptor sensitivity, e.g., in terms of ecological linkages and groundwater vulnerability.

Table 11-1: Criteria for rating Site Importance for Hydrological Attributes (NRA, 2008)

Importance	Criteria	Typical Examples
Extremely High	Attribute has a high quality or value on an international scale.	▪ River, wetland or surface water body ecosystem protected by EU legislation e.g. 'European sites' designated under the Habitats Regulations, or 'Salmonid waters' designated pursuant to the European Communities (Quality of Salmonid Waters) Regulations, 1988.
Very High	Attribute has a high quality or value on a regional or national scale.	▪ River, wetland or surface water body ecosystem protected by national legislation – NHA status ▪ Regionally important potable water source supplying >2500 homes. ▪ Quality Class A (Biotic Index Q4, Q5). ▪ Flood plain protecting more than 50 residential or commercial properties from flooding. ▪ Nationally important amenity site for a wide range of leisure activities.
High	Attribute has a high quality or value on a local scale.	▪ Salmon fishery ▪ Locally important potable water source supplying >1000 homes. ▪ Quality Class B (Biotic Index Q3-4). ▪ Flood plain protecting between 5 and 50 residential or commercial properties from flooding.
Medium	Attribute has a medium quality or value on a local scale.	▪ Coarse fishery. ▪ Local potable water source supplying >50 homes ▪ Quality Class C (Biotic Index Q3, Q2-3). ▪ Flood plain protecting between 1 and 5 residential or commercial properties from flooding.
Low	Attribute has a low quality or value on a local scale.	▪ Locally important amenity site for small range of leisure activities. ▪ Local potable water source supplying <50 homes. ▪ Quality Class D (Biotic Index Q2, Q1) ▪ Flood plain protecting 1 residential or commercial property from flooding. ▪ Amenity site used by small numbers of local people.

Impact significance on hydrological attributes was made in accordance with NRA (2008) involving categorisation of the magnitude of impact (Table 11-2).

Table 11-2: Criteria for Rating the Potential Impacts and their Magnitude (NRA, 2008)

Magnitude of Impact	Criteria	Typical Examples
Large Adverse	Results in loss of attribute and/or quality and integrity of attribute.	▪ Loss or extensive change to a waterbody or water dependent habitat ▪ Increase in predicted peak flood level >100 mm ▪ Extensive loss of fishery ▪ Calculated risk of serious pollution incident >2% annually ▪ Extensive reduction in amenity value
Moderate Adverse	Results in impact on integrity of attribute or loss of part of attribute.	▪ Increase in predicted peak flood level >50 mm ▪ Partial loss of fishery ▪ Calculated risk of serious pollution incident >1% annually ▪ Partial reduction in amenity value
Small Adverse	Results in minor impact on integrity of attribute or loss of small part of attribute.	▪ Increase in predicted peak flood level >10 mm ▪ Minor loss of fishery ▪ Calculated risk of serious pollution incident >0.5% annually ▪ Slight reduction in amenity value
Negligible	Results in an impact on attribute but of insufficient magnitude to affect either use or integrity.	▪ Negligible change in predicted peak flood level ▪ Calculated risk of serious pollution incident <0.5% annually
Minor Beneficial	Results in minor improvement of attribute quality.	▪ Reduction in predicted peak flood level >10 mm ▪ Calculated reduction in pollution risk of 50% or more where existing risk is <1% annually
Moderate Beneficial	Results in moderate improvement of attribute quality.	▪ Reduction in predicted peak flood level >50 mm ▪ Calculated reduction in pollution risk of 50% or more where existing risk is >1% annually
Major Beneficial	Results in major improvement of attribute quality.	▪ Reduction in predicted peak flood level >100 mm

The significance of effects on hydrological receptors is then determined using the matrix shown in Table 11-3 (from NRA, 2008) which considers the sensitivity of the receptor (Table 11-1) and magnitude of the impact (Table 11-2). Effect significance is described as per EPA (2022) terminology:

- **Imperceptible:** An effect capable of measurement but without noticeable consequences.
- **Slight:** An effect which causes noticeable changes in the character of the environment without affecting its sensitivities.
- **Moderate:** An effect that alters the character of the environment in a manner that is consistent with existing and emerging trends.
- **Significant:** An effect which, by its character, magnitude, duration or intensity alters a sensitive aspect of the environment.
- **Profound:** An effect which obliterates all previous sensitive characteristics

Table 11-3: Rating of Significant Environmental Impacts at EIA Stage (NRA, 2008)

		Magnitude of Effect			
		Negligible	Small	Moderate	Large
Importance of Attributes	Extremely high	Imperceptible	Significant	Profound	Profound
	Very high	Imperceptible	Significant/Moderate	Profound/Significant	Profound
	High	Imperceptible	Moderate/Slight	Significant/Moderate	Profound/Significant
	Medium	Imperceptible	Slight	Moderate	Significant
	Low	Imperceptible	Imperceptible	Slight	Slight/Moderate

11.2.6 WFD Status of Water Bodies

The EU WFD provides the framework for protection of inland surface waters, transitional waters, coastal waters and groundwater. The key objectives of the WFD are set out in Article 4 of the Directive. It requires that Member States use River Basin Management Plans (RBMPs) to protect and, where necessary, restore water bodies to obtain good status (or better), and to prevent deterioration of status. Ireland's Water Action Plan forms the Third Cycle RBMP and covers the period 2022-2027.

Surface water status falls into the categories of High, Good, Moderate, Poor or Bad. Ecological status is determined by Biological Quality Elements (BQEs) and supporting water quality conditions, hydrology and morphology. Hydrology and morphology address the river flow and level and other physical conditions of the water channel such as the width, bed shape and substrate. Good surface water status is the combination of good ecological status and good water quality (chemical status).

The BQEs are generally sampled at three-year intervals, while water body WFD status is reported by the EPA to Europe in six-yearly reporting cycles. The EPA also assign a risk category to each water body, interpreted as the "risk" of not meeting the water body WFD objective within timeframes set out in the RBMP. The three risk categories are:

- Waterbodies that are **At Risk** of not meeting their WFD objectives.
- Waterbodies that are **Not at Risk** and, therefore, are meeting their WFD objectives.
- Waterbodies that are categorised as **Review** - additional information is needed to determine their status.

A WFD Compliance Evaluation for the Proposed Development is set out in Appendix C11.04.

11.2.6.1 Biological Water Quality (Q-values)

In Ireland, biological water quality is assessed using the Q-value metric. The system is based on field sampling and observations, which evaluates habitat quality and macroinvertebrate diversity and abundance to interpret ecological status as set out in Table 11-4. The Q-value is a water quality indicator that converts to an Environmental Quality Ratio (EQR), which equates to the WFD status class bands of High, Good, Moderate, Poor and Bad. The EPA operate a system of river monitoring which provides Q-value data for classification of status on a three-yearly cycle which provides the BQE data that underpins the classification of water body status for EU reporting purposes.

Table 11-4: EPA Water Quality Ratings and WFD Status Summary

Biotic Index	EQR	Quality Status	Water Quality	WFD Status
Q5	1.0	Unpolluted	Good	High
Q4-5	0.9	Unpolluted	Fair-to-Good	
Q4	0.8	Unpolluted	Fair	Good
Q3-4	0.7	Slightly Polluted	Doubtful-to- Fair	Moderate
Q3	0.6	Moderately Polluted	Doubtful	Poor
Q2-3	0.5	Moderately Polluted	Poor-to-Doubtful	
Q2	0.4	Seriously Polluted	Poor	Bad
Q1-2	0.3	Seriously Polluted	Bad-to-Poor	

Relevant EPA Q-value monitoring data was reviewed for affected water bodies of the Proposed Development, as set out in Chapter 9B: Biodiversity – Aquatic, Section 9.4.1. In addition, field sampling and assignment of Q-values was carried out using EPA protocols (EPA., 2006) during aquatic ecology field studies on watercourses where the EPA do not routinely monitor. Macroinvertebrate data and Q-values obtained are set out in Chapter 9B: Biodiversity – Aquatic, Section 9.4.1 and Appendix C9B.03. The combination of EPA and site-specific field survey Q-value data was used to assign importance of the hydrological attributes as per Table 11-1, above.

11.2.7 Surface Water Drainage Design Methodology

The Proposed Development requires the construction of new surface water drainage systems across all sections, including new outfalls to existing watercourses or surface water drainage networks. Extensions to existing culverts and the construction of infiltration ditches and attenuation ponds are also included as part of the Proposed Development.

There are a significant number of existing streams and rivers that the Proposed Development traverses along its route. These will be conveyed using culverts and/or bridge structures which have been designed in accordance with the Section 50 of the Arterial Drainage Act,1945, (which requires consent from the Office of Public Works (OPW) for the construction or alteration of bridges and culverts to ensure flood risk management and compliance with hydraulic standards); and requirements of Transport Infrastructure Ireland (TII) Standards: DN-DNG-03064 (HD 106)-Drainage of Runoff from Natural Catchments, DN-DNG-03071 (HD 107) Design of Outfall and Culvert Details, DN-DNG-03022 Drainage Systems for National Roads and DN-DNG-03065 (HD 45)- Road Drainage and the Water Environment.

Statutory consultees were communicated with throughout the project delivery. Additionally, project specific meetings with stakeholders took place to inform the design and environmental assessment of drainage and flooding elements including OPW, IFI and the Loughs Agency.

Culverts have been designed considering the hydraulic requirements for road crossings. Provision for passage of fish and mammals at ecologically sensitive areas were accounted for within the hydraulic design. All required culverts have been designed to minimise impact on both upstream and downstream flood conditions. The relevant application process and consents/approvals relevant to the Proposed Development have been obtained from OPW under section 50 of the Arterial Drainage Act, 1945.

Design of proposed drainage collector systems include:

- Consideration of pollution and flood risk requirements.
- Determination of the design storm used in the design of the drainage elements.
- Calculation of the flows from the design storm within each drainage element.

- Establishment of the hydraulic adequacy of each drainage element.
- Determination of the location of outfalls or soakaways.
- Determination of structural loading upon drainage conduits (where necessary).
- Specification of appropriate chambers and covers.
- The design flows were increased by 20% to allow for the future effects of climate change.

Table 11-5 summarises the design criteria[1] adopted by the Design Team in accordance with OPW requirements for construction of hydraulic culverts and bridges over watercourses.

Table 11-5: Bridge and Culvert Design

Parameter	Criteria
Design Flow	1% AEP* (1 in 100-year Return Period)99999
Climate Change Allowance	20% Increase in Flow to Cater for Climate Change
Minimum Culvert Size	Minimum opening size of 900 mm
Embedment Depth	▪ 500 mm for rectangular box culverts ▪ 300 mm for circular culverts (used on non-fish bearing waters only)
Freeboard	Minimum of 300 mm above Design Flood Water Level

*AEP=Annual Exceedance Probability

In each road Section, most stream catchments are ungauged. Design flows for culverts have therefore been estimated using catchments characteristics based on methods for the ungauged catchments recommended in the 1975 Flood Studies Report (FSR), FSU (2009), and the Agricultural Development and Advisory Service (ADAS, 1980) recommended method for small catchments. Table 11-6 outlines the methods applied for the estimation of culvert design flows based on catchment sizes.

Table 11-6: Culvert Flow Estimation Methods

Catchment Size (km^2)	Calculation Method	Method Reference
<0.4	ADAS	UK MAFF, 1980
0.4 to 25.0	IH 124	IH Report No. 124, 1994
	FSSR 6, 3-Variable Method	FSSR 6, NERC, 1979
	FSU 3-Variable Method	FSU Work Package 4.2, OPW, 2012
	FSU 5-Variable Method	FSU Work Package 4.2, OPW, 2012
> 25.0	FSU 7-Variable Equation	FSU Work Package 2.3, OPW, 2009

Both the Flood Studies Report (FSR) and Flood Studies Update (FSU) methods for estimation of peak flows use the index-flood method, involving two stages - the first stage involves estimating the index-flood (Qmed or Qbar) and in the second stage a flood growth curve is estimated. The index flood can be thought of as a typically sized (mean or median annual maximum flows) flood for a particular catchment, and in the FSU, it is defined as the flood with a 50% probability of being exceeded in a particular year. This is equivalent to the median of the annual maximum flood series, denoted Qmed. In the FSR, the index flood is defined as the flood flow which has an approximate return period of 1 in 2.33 year, which is the mean of the annual

[1] Section 50: Reference Information and Technical Guidance Material for Applicants

maximum flood series, denoted Qbar. The growth curve is a dimensionless version of the flood frequency curve which defines how the flood magnitude grows as the probability reduces, i.e. for more extreme design floods. The design flood for a particular exceedance probability is then simply calculated as the product of index-flood and the value of the growth curve for that probability (known as the growth factor).

The index-flood estimates have been adjusted from a pivotal site, which is ideally a gauging station upstream or downstream or a gauging station from a different catchment which is hydrologically similar. The index-flood estimates have also been factored up by the upper limits of the factorial standard errors associated with the each of the estimation's methods. Further to this, if the watercourse forms part of an OPW arterial drainage scheme, a drainage district factor of 1.6 was applied to all methods as required by the OPW. To cater for the future climate change effects, the above-mentioned peak flow estimates have been increased by 20%.

Further details for flood estimation are provided in the "*Technical Report for OPW Section 50 Applications*".

The following design considerations have been applied to culverts:

- All new culverts have been designed for a flood with a return period of 1 in 100 years with a minimum of 300 mm freeboard between the design water level and the soffit level of the culvert in accordance with the OPW requirements.
- A minimum culvert diameter of 1,200 mm is adopted on all new culverts conveying watercourses to ensure accessibility for future maintenance and reduce the likelihood of blockages in accordance with OPW requirements.
- In general, lengths of new culverts will be kept to a minimum to allow for maximum light penetration. In some instances, this will result in the watercourse being diverted to avoid skew and excessive length.
- The design of all culverts conveying watercourses provides a minimum embedment depth of 300 mm on circular culverts (only used on non-fish bearing channels / drains) or 500 mm on rectangular box culverts below stream bed or to the minimum level as per IFI (2016) guidance and consultation. This is to encourage re-establishment of internal stream bed morphology. The bed of the channel both upstream and downstream of the culvert will be reinstated with material similar to that removed during construction.
- Gradients of proposed culverts will match pre-existing gradient of the watercourse.
- Culverts or pipes with a clear span greater than 2.0 m are classified as structures in accordance with the DN-STR-03001 (BD 2).

11.2.7.1 Pre-Earthworks Drainage

Interceptor ditches will be installed to collect surface water runoff at the top of the cuttings or the base of the embankments where the adjacent land falls towards the Proposed Development. Any land drains that are interrupted by the new works will be diverted or discharged into an interceptor ditch. This 'clean' discharge is to existing land drains, streams and rivers. Cross-drains will be provided to convey flow from the interceptor ditches beneath the Proposed Development to the outfall/discharge locations where required.

Interceptor ditches have been sized to cater for a 1 in 75-year return period as per DN-DNG-03064 (HD 106) Drainage of Runoff from Natural Catchments. Table 11-7 presents the design criteria for the interceptor ditches and associated cross-drains (ref. DN-DNG-03064 (HD 106). The typical interceptor details are outlined in Table 11-8.

Table 11-7: Interceptor Ditch & Interceptor Cross-Drain Design Criteria

Parameter	Criteria
Flood Estimation Method	Catchment Area < 0.4 km^2-ADAS Estimation Method Catchment Area > 0.4 km^2- IH124 Estimation Method
Return Period (years)	75
Climate Change	20% increase on flows
Min. Dia. Cross-Drain	450 mm
Max. Channel Velocity	2.5 m/s

Table 11-8: Typical Interceptor Ditch Details

Ditch Type	Type 1
Base Width (m)	1
Side Slope (1:X)	1
Ditch Depth (m)	0.6 to 1
Freeboard Included (m)	0.3
Minimum Longitudinal Gradient (1:X)	500
Manning's 'n' Roughness	0.05

11.2.7.2 Road Surface and Sub-Grade Water Drainage

Drainage systems for the Proposed Development are designed such that surface water drainage and sub-grade drainage are provided for the mainline carriageway, link roads and all new sections of local and regional roads. These designs have been prepared in accordance with the design criteria recommended in the TII Publications suite of drainage standards as mentioned in Section 11.2.3. A summary of the main design requirements from TII publications drainage design documents are listed in Table 11-9.

Table 11-9: Network Drainage Design Requirements

Drainage Element	Design Requirement	Reference TII Publication
Longitudinal Drains	▪ One in one-year in-bore without surcharge ▪ One in five-year without flooding	DN-DNG-03022 Section 6.2
Transverse Drains including gully connections crossing beneath the carriageway	1 in 50-years in bore without surcharge or a minimum of 300 mm	DN-DNG-03022 Section. 6.2
Combined Surface Water and ground water drains	▪ One in one-year in bore without surcharge ▪ One in five-year causing no surcharge above the formation/ sub formation where capping is present	DN-DNG-03022 Section 6.2
Surface Water Channels	One in one-year contained within the channel & check one in five-year against allowable surcharge width	DN-DNG-03022 Section 6.3

Drainage Element	Design Requirement	Reference TII Publication
Allowable surcharge width at edge of pavement during one in five-year storm	▪ Hard shoulder/hardstrip width minus 0.5 m when HS ≥ 1 m ▪ Or 0.5 m on roads with no hardstrips or hardstrips < 1 m.	DN-DNG-03022 Section 2.8
Climate Change	20% increase in rainfall intensity	DN-DNG-03022 Section 6.3
Peak Flow Rates	"No worsening" in peak flow rates at the scheme boundary up to the 1 in 100-year return period storm event	DN-DNG-03022 Section 7.2
Runoff Attenuation	1 in 100-year without surcharge	DN-DNG-03022 Section 7.2
Minimum Pipe Diameters	225 mm (Except Gully connector permitted at 150 mm)	DN-DNG-03022 Section6.21
Pipe Diameters Combined Filter Drains	Minimum: 225 mm Maximum: 450 mm	
Minimum Pipe Velocity	0.75 m/s	DN-DNG-03022 Section 6.10.1
Maximum Discharge Velocity	2.5 m/s at one in one year	DN-DNG-03022 Section 6.10.1
Maximum Manhole/ Catchpit Spacing	100 metres	DN-DNG-03022 Section 6.4
Minimum cover for drainage structures	1.2 m without protective measures	
Pipe Roughness	Carrier Drains 0.6 mm Filter Drains: 1.5 mm	HA 33
Runoff Coefficients	Paved: 1.0 Cuts Slopes: 0.5 Verges: 0.5	
Manning's "n" for roads	0.017	HD 102 Para. 4.3
Manning's "n" for boundary drains	0.05	HD 106 C.2

The design approach across all three sections ensures that all mainline road surface drainage is carried by means of a road drainage network to surface attenuation features before discharging to watercourses at greenfield run-off rates. Further details regarding attenuation features are provided in Section 11.2.7.4. The design endeavours to also include other road alignments that can be captured by the mainline drainage network and fully attenuated.

For the mainline and side roads the flowing drainage systems/types will be used:

- Cuttings and low embankments in non-sealed areas: filter drains and / or grassed surface water channels.
- Cuttings and low embankments in sealed areas (due to vulnerable aquifers): concrete surface water channels with separate sub surface drain / filter drain.
- Embankments-non sealed areas: over the edge or surface water channels.
- Embankments in sealed areas: concrete surface water channels.
- Kerbed junctions: drainage kerbs / kerbs and gullies.

The drainage system for the side roads and accommodation roads is generally not sealed. Filter and narrow filter drains are generally used in cuttings, over the edge and surface water channels on embankments and drainage kerbs or kerbs and gullies on structures/bridges, junctions and slip roads.

Piped drains will collect the water and discharge it to an outfall, interceptor ditch or to the mainline drainage system in some cases. The final outfalls will be the existing watercourses, or infiltration trenches where no watercourses are accessible, or near the outfall. Surface runoff from some side roads is attenuated before discharging to watercourses.

Minor access roads and access tracks will be drained over the edge to interceptor ditches and will be conveyed to a final outfall as mentioned above. Drainage of Access Roads and underpasses will be in accordance with the Minimum Specification for Farm Roadways and Underpasses (Department of Agriculture, Food and the Marine, S.199 March 2024). However, all proposed new link roads will be provided with attenuation facilities to ensure that there is no worsening of peak flows rates at site boundaries up to the 1 in 100-year flood event in accordance with DN-DNG-03022-(HD33) Drainage Systems for National Roads.

11.2.7.3 Cycle Tracks

Cycle tracks will be drained by the one of the following three methods:

1. Over the edge to adjacent interceptor ditches.
2. Into the mainline and sideroad drainage systems. Where convenient, adjacent drainage systems for the mainline and sideroads in the form of filter drains and surface water channels will take pavement runoff from the cycle tracks.
3. Where neither of the above methods (1 or 2) are suitable, a unique filter drain or surface water channel will be provided specifically for the cycle track drainage.

All three methods are used in the Proposed Development, depending on the location and cross-section.

11.2.7.4 Outfalls and Attenuation Ponds

Attenuation ponds have been provided at all major surface water outfalls along the length of the Proposed Development where sufficient land is available and have been designed in accordance with DN-DNG-03063-(HD 103) vegetated drainage systems for road runoff. Additionally, where discharge is to ground via infiltration, infiltration basins/trenches are provided at the outfall.

Surface water discharge from attenuation ponds will be released at a rate so as not to increase flooding downstream of any discharge point up to the 1 in 100-year return period storm event. Discharge will be provided from the attenuation measures at the green-field runoff rate.

Attenuation ponds have been designed to cater for storm water storage up to and including the 1 in 100-year return period storm event with a 20% increase in flows to cater for the effects of climate change. An additional 300 mm freeboard has been included at all attenuation facilities. An overflow discharge facility has been provided for storms in excess of the freeboard. Where attenuation ponds are to be located in areas liable to flooding, e.g. river floodplains, ponds have been designed for a 1 in 100-year return period and an assessment of the impact of the pond on the hydraulic regime of the watercourse has been undertaken and the pond bunded to a level 500 mm above the adjacent 1 in 100 year flood level. Flood compensatory measures have been included where the provision of the attenuation pond reduces the area available to flood in the current scenario. Chapter 4: Project Description provides additional detail on the attenuation ponds, including their locations.

11.2.7.5 Viaducts and Bridge Structures

For the river bridges, a sealed drainage system will capture runoff from the bridge deck and connect to the road drainage network. From there, it will be conveyed to an attenuation pond before discharge to the respective rivers. These rivers are: River Finn (Sections 1 and 3), Cloghroe River (Section 1), River Swilly (Section 2), River Deele (Section 3), and Swilly Burn (Section 3).

11.2.8 Treatment of Run-off and Accidental Spillage

In accordance with DN-DNG-03065-(HD 45) Road Drainage and the Water Environment (NRA, 2015b) a serious spillage pollution risk assessment has been completed for each of the drainage networks discharging to surface watercourses and groundwater bodies; refer to Section 11.5.1.4 for details on Section 1; Section 11.5.2.4 for details on Section 2; and Section 11.5.3.4 for details on Section 3). This assessment calculates the probability of a spillage with potential to cause a serious pollution incident (PINC) occurring. The prescribed acceptable risk of a serious PINC occurring is where the annual probability is predicted to be less than 1%. In specific areas, i.e. where the road drainage outfalls to an SAC or SPA the acceptable risk is reduced to 0.5%.

Sustainable drainage systems (SuDS) were the first preference for surface water collection. Only where there was insufficient space or the road geometry precludes their inclusion (e.g. on embankments higher than 1.5 m or in cuttings with groundwater drainage problems) were other methods used. In general, where the risk to groundwater is low combined filter drains form the first treatment against pollutants making their way into surrounding water bodies as combined filter drains can reduce the release of pollutants. The filter material will trap suspended solids and other contaminants thus reducing the downstream pollution risk. Where the Proposed Development carriageway runoff will drain into grassed surface water channels, the slow-moving flow through the wide shallow grassed channels will allow for the processes of sedimentation and adsorption to take place while carrying the runoff to the outfall (refer to Chapter 4: Project Description).

11.2.9 Flood Risk Assessment Methodology

Any potential impacts on the existing flooding regimes likely to be caused by the Proposed Development were assessed through hydraulic modelling of the relevant river/stream channels. Appropriate remedial measures were integrated into the proposed designs to minimise any predicted impacts. Sources of information used to inform the flood risk assessment of the Proposed Development are listed in Table 11-11.

Flood risk along the Proposed Development was assessed in accordance with "*The Planning System and Flood Risk Management Guidelines for Planning Authorities*" (Department of Housing, Planning and Local Government, 2009). Flood Risk Assessments (FRAs) were conducted to identify risk of flooding to land, property and people. FRAs used the Source-Pathway-Receptor (S-P-R) conceptual model to identify the sources of flooding, the flow paths of the floodwaters and the people and assets impacted by the flooding. The following steps were taken in accordance with the guidelines:

- **Stage 1 Flood Risk Identification** – To identify whether there may be any flooding or surface water management issues related to either the area of regional planning guidelines, development plans and Local Area Plans (LAP) or a Proposed Development site that warranted further investigation at the appropriate lower-level plan or planning application levels.

- **Stage 2 Initial Flood Risk Assessment** – To confirm sources of flooding that may affect a plan area or Proposed Development site, to appraise the adequacy of existing information and to scope the extent of the risk of flooding which may involve preparing indicative flood zone maps. Where hydraulic models exist the potential impact of a development on flooding elsewhere and of the scope of possible mitigation measures can be assessed. In addition, the requirements of the detailed assessment should be scoped.

- **Stage 3 Detailed Flood Risk Assessment** – To assess flood risk issues in sufficient detail and to provide a quantitative appraisal of potential flood risk to a proposed or existing development or land to be zoned, of its potential impact on flood risk elsewhere and of the effectiveness of any proposed mitigation measures.

The Department of Housing, Planning and Local Government (2009) guidelines identify three levels of flood zones:

- **Flood Zone A** where the probability of flooding from rivers and the sea is highest (greater than 1% or 1 in 100 for river flooding or 0.5% or 1 in 200 for coastal flooding).

- **Flood Zone B** where the probability of flooding from rivers and the sea is moderate (between 0.1% or 1 in 1000 and 1% or 1 in 100 for river flooding and between 0.1% or 1 in 1000 year and 0.5% or 1 in 200 for coastal flooding).

- **Flood Zone C** where the probability of flooding from rivers and the sea is low (less than 0.1% or 1 in 1,000 for both river and coastal flooding). Flood Zone C covers all areas of the plan which are not in zones A or B.

OPW guidelines on applying for consents for the Construction, Replacement or Alterations of Bridges and Culverts under section 50 of the Arterial Drainage Act, 1945 were also followed.

In ungauged catchments, design flood flows for proposed bridges/culverts were estimated in accordance with the FSR and FSU methodologies. Appropriate allowances to cater for the future climate change impacts were applied to the design flow estimates (i.e. 20% increase in Peak Flood Flows for the Mid-Range Future Scenario) as set out in the 'Climate Change Sectoral Adaptation Plan, Flood Risk Management' (Office of Public Works, 2019).

11.3 Consultation

Consultation relevant to water and drainage was undertaken with the following stakeholders:

- Donegal County Council Water Services
- OPW
- IFI
- Uisce Éireann (UÉ)
- Loughs Agency
- NI Department of Agriculture, Environment and Rural Affairs (DAERA)
- NI DAERA – Marine and Fisheries Division
- NI Department for Infrastructure, Rivers
- Northern Ireland Environment Agency

A summary of relevant stakeholder responses has been provided in Table 11-10. The concerns listed were dealt with during the lifecycle of the preliminary design and EIAR preparation phases of the project with further consultation, if/where necessary, as the design progressed.

Table 11-10: List of Consultations

Stakeholder	Stakeholder Response Summary	Comments Addressed
IE OPW	Do not interfere with access for maintenance work for Arterial Drainage Districts. CFRAM Plans for Areas for Further Assessment (AFA) in this area will be finalised Q4 2017 and should be considered in the proposal.	Arterial drainage and CFRAM plans addressed in Section 11.4.
IFI	Observations submitted in meetings, relating to crossing of streams and significant rivers. Stated that riverbanks needed to be accessible for fishing amenity where large structures were provided. Stated that all construction works, and work methods require robust silt controls.	Construction phase mitigation detailed in Section 11.9.1 and Chapter 9B: Biodiversity - Aquatic.
UÉ	UÉ encourage the use of SuDS and Green-Blue Infrastructure to manage surface water. New stormwater connections to the public wastewater network will not be permitted.	Section 11.2.8 - Surface water management including SuDS
Loughs Agency	Meeting arranged between Land Liaison Officers (LLO) and Loughs Agency personnel, as well as Section 1 and 3 Design Teams. All instream culvert construction methods at fish bearing waters are subject to Foyle Fisheries Act 1952 Section 47 and Section 70 permits via the Loughs Agency, covering instream works and fish removals, respectively.	Construction phase mitigation detailed in Section 11.9.1 and Chapter 9B: Biodiversity - Aquatic.
NI DAERA - Drainage and Water	(1) There may be transboundary issues regarding drainage and water. Refer to NI advice and guidelines. (2) Consider surface water during construction and operational phases. Site drainage destinations should be identified. (3) Consideration of proposed works liable to affect waterways including any culverting. (4) Comply with best practices. Apply appropriate mitigation during construction, operation and decommissioning phases. (5) Provision of CEMP including Method of Works Statements for all works liable to affect waterways.	(1) Transboundary Issues Chapter 19: Interactions & Cumulative Effects. (2), (4), (5) All details regarding works during construction and operational phases covered in Chapter 4: Project Description and Environmental Operating Plan (EOP). (3) Impact of works on waterways- Section 11.8.3
NI DAERA - Marine and Fisheries Division	(1) Section 2 and 3 cross tributaries of the Foyle which directly connects to NI marine areas. Transboundary effects should be assessed. (2) Refer to standing Northern Ireland advice and guidelines.	Transboundary Issues Chapter 19: Interactions & Cumulative Effects.
NI Department for Infrastructure, Rivers	Please provide more detailed maps of the NI watercourses within the vicinity of the proposals Regarding the link road bridge between county's Donegal and Tyrone over the River Finn. Within Northern Ireland a Schedule 6 application is required to be submitted to the Department regarding any works that affect a watercourse e.g. discharge of storm water to a watercourse, construction of a bridge across or culverting of a watercourse, diversion of a watercourse and other works adjacent to or that will affect a watercourse.	Section 3 Schedule 6 Applications and Applications are provided in Appendix C11.03.

11.4 Existing Environment

A desktop study was undertaken to review water features within the three road sections of the Proposed Development. The assessment covers a zone of radius 250m either side of the Proposed Development in accordance with The TII Guidelines Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes (NRA, 2008). Where required, assessments extended outside of the 250m zone, i.e., where the catchment characteristics of a river several kilometres upstream of the scheme had to be considered.

Potential environmental impacts to watercourses are likely to occur close to points where the Proposed Development intersects with water channels. An exception is flooding resulting from the Proposed Development which may impact areas further upstream and downstream. The above TII guideline for national road schemes recommends the following attributes (and impacts) to be assessed for the hydrology (surface water) topic:

- Watercourses crossed by the Proposed Development and potential impact on water quality arising from re-alignment works and discharge of surface water run-off.
- Aquatic ecological sites close to and downstream of water crossings.
- Surface water abstraction close to and downstream of water crossings.
- Established amenity value of surface waters traversed by each section of the Proposed Development.
- Potential increase (or reduction) in flood risk to existing properties.

Sources of information used in the hydrological assessment are listed in Table 11-11.

Table 11-11: Sources of Hydrological Information

Topic	Sources
Hydrological Drainage Features	▪ OPW Arterial Drainage mapping (https://www.floodinfo.ie) ▪ OSI National Townland Historic 6-inch Mapping (https://geohive.maps.arcgis.com/)
Catchments	▪ North Western – Neagh Bann CFRAM Study delineated catchment maps ▪ Local Authorities (Environment section) ▪ EPA/ WFD Catchment Maps (https://gis.epa.ie/EPAMaps/) ▪ OPW FSU Web Portal (https://opw.hydronet.com)
River Flows	▪ Hydrometric section, OPW (www.opw.ie) ▪ HydroNet site, EPA (https://epawebapp.epa.ie/hydronet/) ▪ OPW FSU Web Portal (https://opw.hydronet.com)
Flooding	▪ OPW Flood Hazard & Flood Risk Information (https://www.floodinfo.ie) ▪ Local Authorities (DCC) ▪ OPW PFRA ▪ Irish Coastal Protection Strategic Study (ICPSS) prepared flood maps (Office of Public Works, 2013) ▪ Irish Coastal Wave and Water Level Modelling Study (ICWWS,2018) (Office of Public Works, 2020) ▪ Groundwater Flood Maps, GSI
Water Quality	▪ Local Authorities (Environment sections) ▪ EPA/ WFD Water Quality Maps(https://gis.epa.ie/EPAMaps/) ▪ EPA Catchments (https://catchments.ie)
Surface Water Features	▪ 1:50,000 Discovery Series Maps (OSI) ▪ 1:10,560 Maps (OSI) ▪ EPA Blueline Network ▪ OSI National Townland Historic 6-inch Mapping
Public Water Supply (PWS)	▪ Irish Water ▪ Local Authorities ▪ Group Water Schemes

11.4.1 Section 1 Existing Environment

11.4.1.1 Catchments

The following section provides a general description of the principal river catchments in the area of Section 1. The entire scheme area lies within the River Foyle Catchment and forms part of the National Hydrometric Area – 01. The major sub-catchments within this area are the River Finn and the River Deele catchments. The majority of the potentially affected surface waters are within the River Finn catchment, with the Cloghroe River main channel and one small tributary of the Cloghroe River (Deele catchment) affected.

The River Finn is one of the major tributaries of the greater Foyle catchment (HA 01) and emanates from the Bluestack and Glendowan Mountains in the interior of Donegal. The River Finn flows into the River Mourne to form the River Foyle at Lifford/Strabane. The Finn catchment is a medium to large sized catchment (502 km^2) with a mixture of peat, pasture and forest coverage. The scheme area includes several tributaries of the Finn with catchments ranging in size from 2 km^2 to 26 km^2. The largest of these is the Burn Daurnett which flows from the southwest of the scheme area. The tributaries largely emanate from farmland within the Finn Valley, although the Burn Daurnett represents a more upland catchment with a fair degree of peat land coverage.

The River Deele is a medium sized catchment (134 km^2) that forms part of the greater Foyle Catchment and originates in the hilly area to the west of the village of Convoy. The catchment is largely agricultural land with some peat and forest land coverage. The River Deele flows into the River Foyle approximately 2.8 km downstream of the River Finn/River Foyle confluence.

Table 11-12 presents the physical catchment descriptors (PCDs) for the River Finn and Deele at their confluences with the river Foyle (ref. OPW, FSU, 2009).

Table 11-12: Section 1 FSU Catchment Characteristics

PCDs	River Finn	River Deele
Area (km^2):	502	134
Standard Average Annual Rainfall (SAAR) (mm):	1,037.5	1,290
Flood Attenuation from Reservoirs and Lakes (FARL):	0.024	1.0
Baseflow Index of Soils (BFISOIL):	0.561	0.402
Drainage Density (DRAIND) km per km^2:	1.493	1.493
Channel Flood Slope S1085 (m/km):	3.245	5.53
Arterial Drainage Factor (ARTDRAIN^2):	0	0
URBEXT (Urban Extent):	0.0004	0.0085

An overview of the watercourses potentially impacted by Section 1 are presented in Table 11-13 and illustrated in Figure 11-1. The extent of the River Finn and River Deele catchment areas and hydrometric gauge locations are illustrated in Figure 11-2. EIAR Drawing 9B.01 in Volume D: Book of Drawings (Watercourse Survey Locations – Section 1) contains higher resolution maps of EPA watercourse and water body names, including aquatic biodiversity survey site locations on each that underpinned the identification of water receptor sensitivity. See Appendix C9B.01 for detailed aquatic survey site habitat and summary data and Appendix C9B.02 for representative images of aquatic ecology survey points on watercourses.

Table 11-13: Section 1 Overview of Potentially Impacted Watercourses

EPA Name	EU River Waterbody Code	Watercourse Segment Code	Relevant aquatic Ecology Survey Site(s) Ref	WFD Catchment	WFD Sub-Catchment	WFD River Water Body Name
Burn Daurnett	IE_NW_01B020200	01_1815	W1-22	Foyle	Finn (Donegal)_SC_040	BURN DAURNETT_010
Un-named (Trib of Burn Daurnett)	IE_NW_01B020200	01_1826	W1-01, W1-02	Foye	Finn (Donegal)_SC_040	BURN DAURNETT_010
Cappry	IE_NW_01B020200	01_1816	W1-03, W1-04, W1-05	Foyle	Finn (Donegal)_SC_040	BURN DAURNETT_010
Finn [Donegal]	IE_NW_01F010600	01_810	W1-06	Foyle	Finn (Donegal)_SC_030 / Finn (Donegal)_SC_040	FINN (DONEGAL)_050
Finn [Donegal]	IE_NW_01F010800	01_7147	W1-06	Foyle	Finn (Donegal)_SC_030 / Finn (Donegal)_SC_040	FINN (DONEGAL)_060
Finn [Donegal]	IE_NW_01F010800	01_590	W1-06	Foyle	Finn (Donegal)_SC_030 / Finn (Donegal)_SC_040	FINN (DONEGAL)_060
Finn [Donegal]	IE_NW_01F010800	01_591	As for W1-06	Foyle	Finn (Donegal)_SC_030 / Finn (Donegal)_SC_040	FINN (DONEGAL)_060
Aghasheil	IE_NW_01F010800	01_553	W1-23	Foyle	Finn (Donegal)_SC_040	FINN (DONEGAL)_060
Drumboe Lower	IE_NW_01F010800	01_589	W1-07	Foyle	Finn (Donegal)_SC_030	FINN (DONEGAL)_060
Greenhills 01	IE_NW_01F010800	01_70	W1-10	Foyle	Finn (Donegal)_SC_030	FINN (DONEGAL)_060
Backlees	IE_NW_01F010800	01_186	W1-08, W1-09	Foyle	Finn (Donegal)_SC_030	FINN (DONEGAL)_060
Kilross 01	IE_NW_01F010800	01_543	W1-15	Foyle	Finn (Donegal)_SC_030	FINN (DONEGAL)_060
Tircallan	IE_NW_01F010910	01_3	W1-16	Foyle	Finn (Donegal)_SC_030	FINN (DONEGAL)_060
Mullaghagarry	IE_NW_01F010910	01_776	W1-18, W1-20	Foyle	Finn (Donegal)_SC_030	FINN (DONEGAL)_070
Mullaghagarry	IE_NW_01F010910	01_69	W1-17	Foye	Finn (Donegal)_SC_030	FINN (DONEGAL)_070
Treanamullin	IE_NW_01F010910	01_66	W1-19	Foyle	Finn (Donegal)_SC_030	FINN (DONEGAL)_070
Castlebane 01	IE_NW_01F010910	01_67	Drain entering upstream W1-18	Foyle	Finn (Donegal)_SC_030	FINN (DONEGAL)_070
Lisnaree	IE_NW_01D010500	01_928	W1-12	Foyle	Deele (Donegal)_SC-010	Deele (Donegal)_030
Magheracorran	IE_NW_01D010500	01_1024	W1-11	Foyle	Deele (Donegal)_SC-010	Deele (Donegal)_030
Magheracorran	IE_NW_01D010500	01_1530	W1-13	Foyle	Deele (Donegal)_SC-010	Deele (Donegal)_030
Cloghroe 010	IE_NW_01C050400	01_1796	W1-11	Foyle	Deele (Donegal)_SC-010	Cloghroe_010

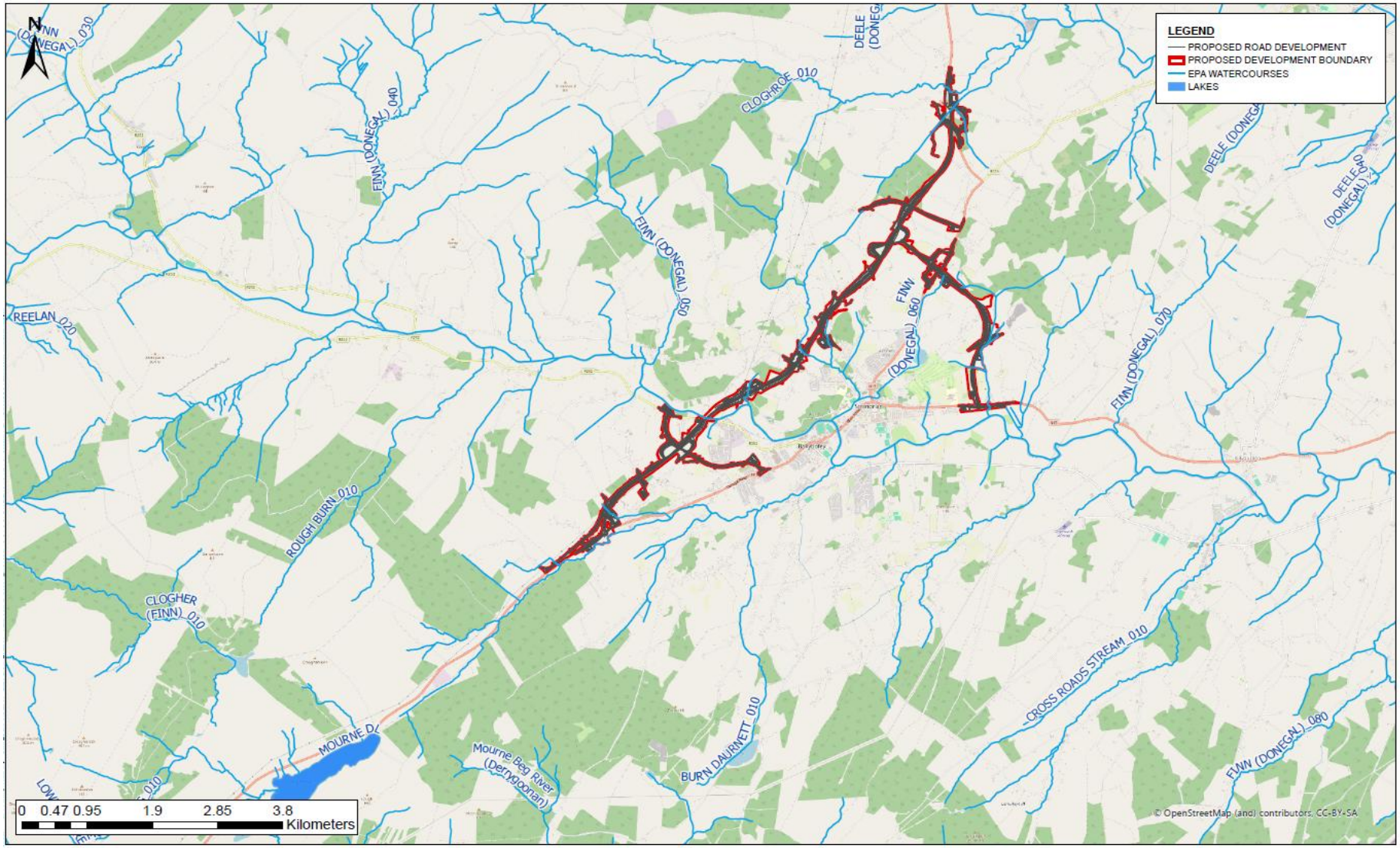

Figure 11-1: Section 1 Direct EPA Delineated Watercourse Interactions

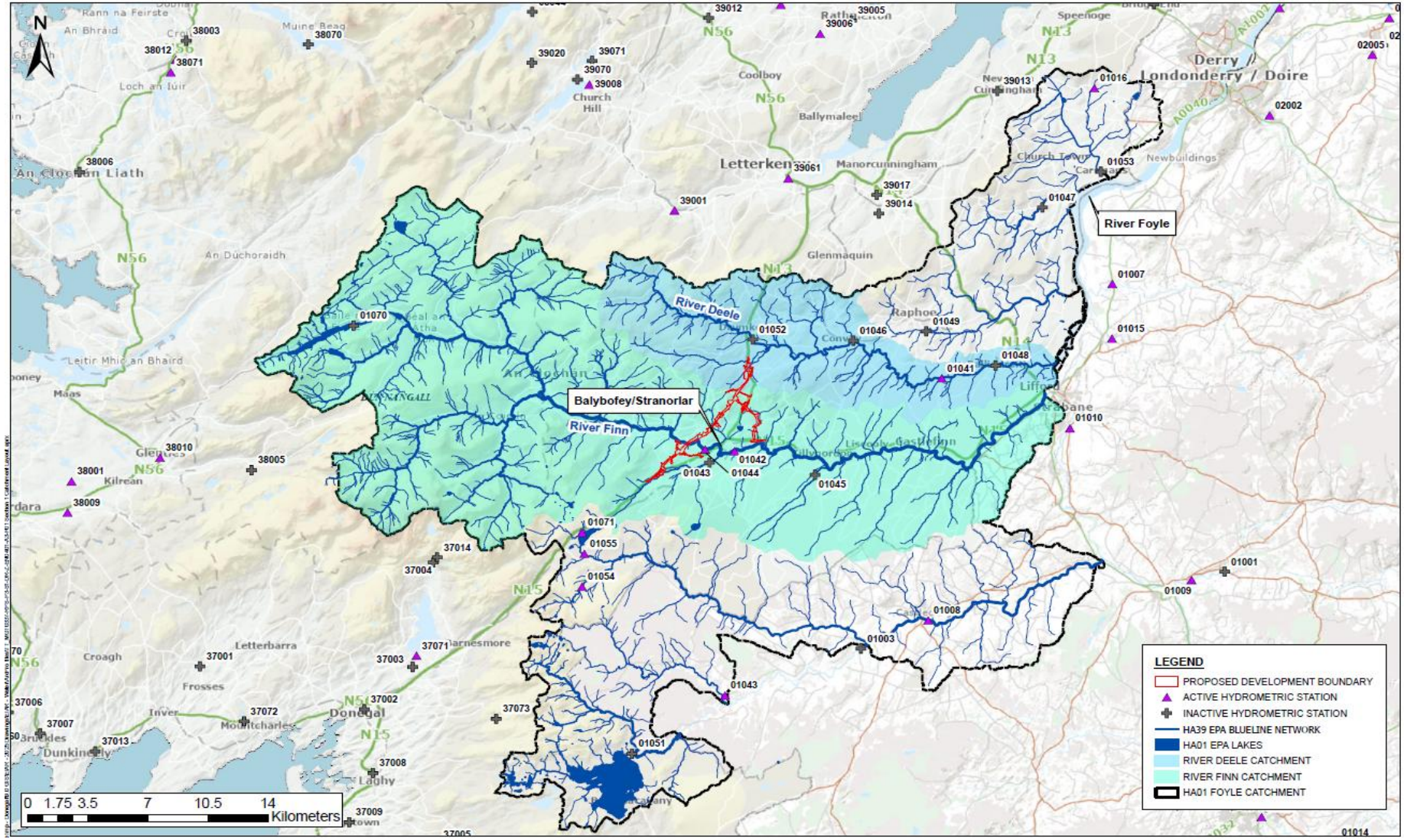

Figure 11-2: Section 1 Surface Water Features, Catchments (FSU 2022) and Hydrometric Gauge Locations

11.4.1.2 Ecological Importance of Hydrological Sites

See Chapter 9B: Biodiversity – Aquatic, Table 9B.19 for ecological importance of watercourses relevant to the Section 1 Proposed Development, including International and national designations. The data fed into the assigning of hydrological importance for the current assessment as per Table 11-1, above.

11.4.1.3 Hydrology

The entire scheme area lies within the River Foyle Catchment and forms part of the National Hydrometric Area – 01. The main surface water features potentially impacted by Section 1 include the River Finn and a number of its tributaries and the Cloghroe River a tributary to the River Deele (Donegal). As part of the Northwestern - Neagh Bann CFRAM Study, a detailed hydrology report was prepared by RPS in 2015 for the UoM 01 (Donegal)2. Ballybofey/Stranorlar was one of 26 AFAs identified during the Preliminary Flood Risk Assessment process in UoM 01 for further hydrological and hydraulic analysis. Design flows of various return periods were calculated along the river Finn and its tributaries using best practice guidance for Irish catchments generally as outlined in the FSU (FSU, OPW, 2009) and supplemented with other methodologies where these were considered more appropriate.

Table 11-14 provides a summary of catchment characteristics and estimated design flows for all watercourses that are to be crossed by Section 1.

Figure 11-3 and illustrate the locations of these watercourses. These design flows have been estimated as part of this project using the FSU and FSR (Natural Environment Research Council, 1975) recommended methodologies.

[2]North Western – Neagh Bann CFRAM Study – UoM 01 Hydrology Report, RPS 2015

Table 11-14: Section 1 Catchment Characteristics and Design Flows of Potentially Impacted Watercourses

				Estimated Flows (m^3/s)					
EPA River Name	Water Course Segment	Culvert Ref	Chainage	Area (km2)	SAAR (mm)	S1085 (m/km)	Baseflow Index (BFI)	Qmed	Q100 (incl 20% CCA)
Un-named (Trib of Burn Daurnett)	01_1826	S1-CUL01	CH1+300 (L-6564 Connector)	0.98	1,705	17.6	0.334	1.442	5.89
Cappry	01_1816	S1-CUL08, S1-CUL09 & S1-CUL10	CH0+220 (Mainline 1.2)	0.52	1,682	21.94	0.34	0.82	3.35
Finn [Donegal]	01_810	Finn River Bridge Crossing	CH2+435 (Mainline 1.2)	310	1,995	6.22	0.297	263.99	606.58
Drumboe lower	01_589	S1-CUL12 & S1-CUL13	CH0+155 (L-2754 Connector) (S1-CUL13)	0.83	1,348	25.86	0.51	0.689	2.91
Greenhills 01	01_70	S1-CUL15, S1-CUL16 & S1-CUL17	CH4+800 (S1-CUL15 Mainline 1.2)	0.21	1,705	0	0	0	0.69
Backlees	01_186	Backlees River Crossing & S1-CUL14	CH4+100 (Backlees River – mainline 1.2)	4.98	1,372	20.54	0.331	5.16	20.77
Kilross 01	01_543	S1-CUL21	CH1+610(N15 Primary Road Connector)	1.74	1,289	46.64	0.372	1.995	7.95
Tircallan	01_3	S1-CUL22	CH1+765(N15 Primary Road Connector)	1.87	1,289	46.64	0.372	2.132	8.5

Estimated Flows (m^3/s)									
EPA River Name	**Water Course Segment**	**Culvert Ref**	**Chainage**	**Area (km2)**	**SAAR (mm)**	**S1085 (m/km)**	**Baseflow Index (BFI)**	**Qmed**	**Q100 (incl 20% CCA)**
Mullaghagarry	01_776	Mullaghagarry River Crossing (S1-CUL28)	CH0+155 (Mullaghagarry at N15 Treanamullin Tie-in)	5.89	1,243	41.56	0.40	5.73/9.66 (FSE-1.686 FSU 5-var)	15.41/25.979
Mullaghagarry	01_69	S1-CUL25	CH0+375(Connector farm access)	4.68	1,252	54.5	0.398	4.683	18.76
Treanamullin	01_66	S1-CUL27	CH3+175(LX-1007-1 Northern Link Road)	0.26	1,705	N/A	N/A	N/A	0.85
Castlebane 01	01_67	S1-CUL26	CH0+250 (L-2714 Connector)	0.23	1,705	N/A	N/A	N/A	0.83
Lisnaree	01_928	S1-CUL32, S1-CUL30, S1-CUL33	CH0+615(S1-CUL33, L-6674 Connector)	0.92	1,260	17.81	0.464	0.691	3.09
Magheracorran	01_1024	S1-CUL34, S1-CUL35 & S1-CUL36	CH8+500 (Mainline 1.2) (S1-CUL-36)	1.04	1,360	38.88	0.34	1.375	5.42
Magheracorran	01_1530	S1-CUL31	CH0+025 (LX-1011 Connector)	2.84	1,312	28.03	0.368	2.851	11.48
Cloghroe 010	01_1796	Cloghroe River Crossing	CH0+300(Mainline 1.3)	10.75	1,503	24.83	0.32	12.75	51.08

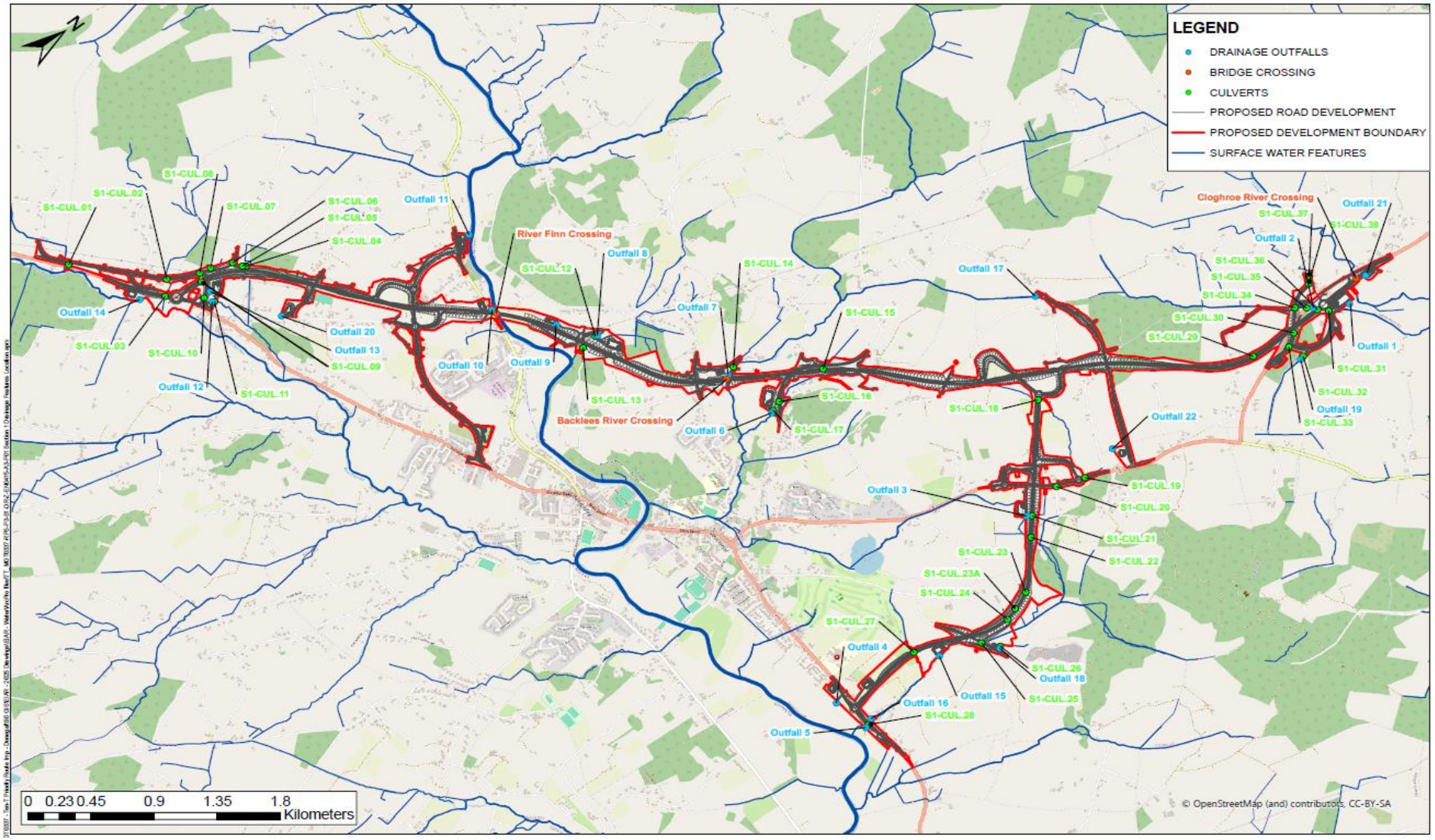

Figure 11-3: Section 1 Locations of Bridge Crossings and Drainage Outfalls

11.4.1.4 WFD Status and Q-values

WFD water body status and risk category for watercourses within the Proposed Development are provided in the WFD Compliance Evaluation in Appendix C11.04. Water body status and risk category for the current reported period (2019-2024) are illustrated in Figure 11-4 and Figure 11-5, respectively.

River Q-values

Table 11-15 presents the most recent EPA Q-value monitoring data for River Finn, Burn Daurnett, Cloghroe and Deele rivers in the vicinity of the Section 1 Proposed Development. Chapter 9B: Biodiversity – Aquatic, Appendix C9B-01 and C9B-03 contain additional Q-value data from watercourses that were suitable for kick-sampling across the Proposed Development derived during field studies over the ongoing environmental assessment phase between 2020 and 2025.

Table 11-15: EPA Q-Value Data – River Finn, Burn Daurnett, Cloghroe and Deele Rivers

EPA Code	Station Name	2016	2019	2022	2025
01F010600	**Finn - Bridge 2.5 km u/s Ballybofey**	3	3-4	4-5	4
01F010800	**Finn - Br S of Stranorlar**	3	3	4	3-4
01F010900	**Finn - Bridge S. of Killygordon**	3	3-4	3-4	3-4
01B020010	**Burn Daurnett - Blackburn Br**	2-3	3-4	3-4	3
01B020200	**Burn Daurnett - Bridge N.W. of Daisy Hill**	3	3-4	3-4	3
01C050400	**Cloghroe - Br d/s Callan Bridge**	3	3-4	4	4
01D010200	**Deele (Donegal) - Second Br d/s Br near Newtown**	3	3-4	3-4	4
01D010300	**Deele (Donegal) – Glasly Bridge**	~	4	3-4	4

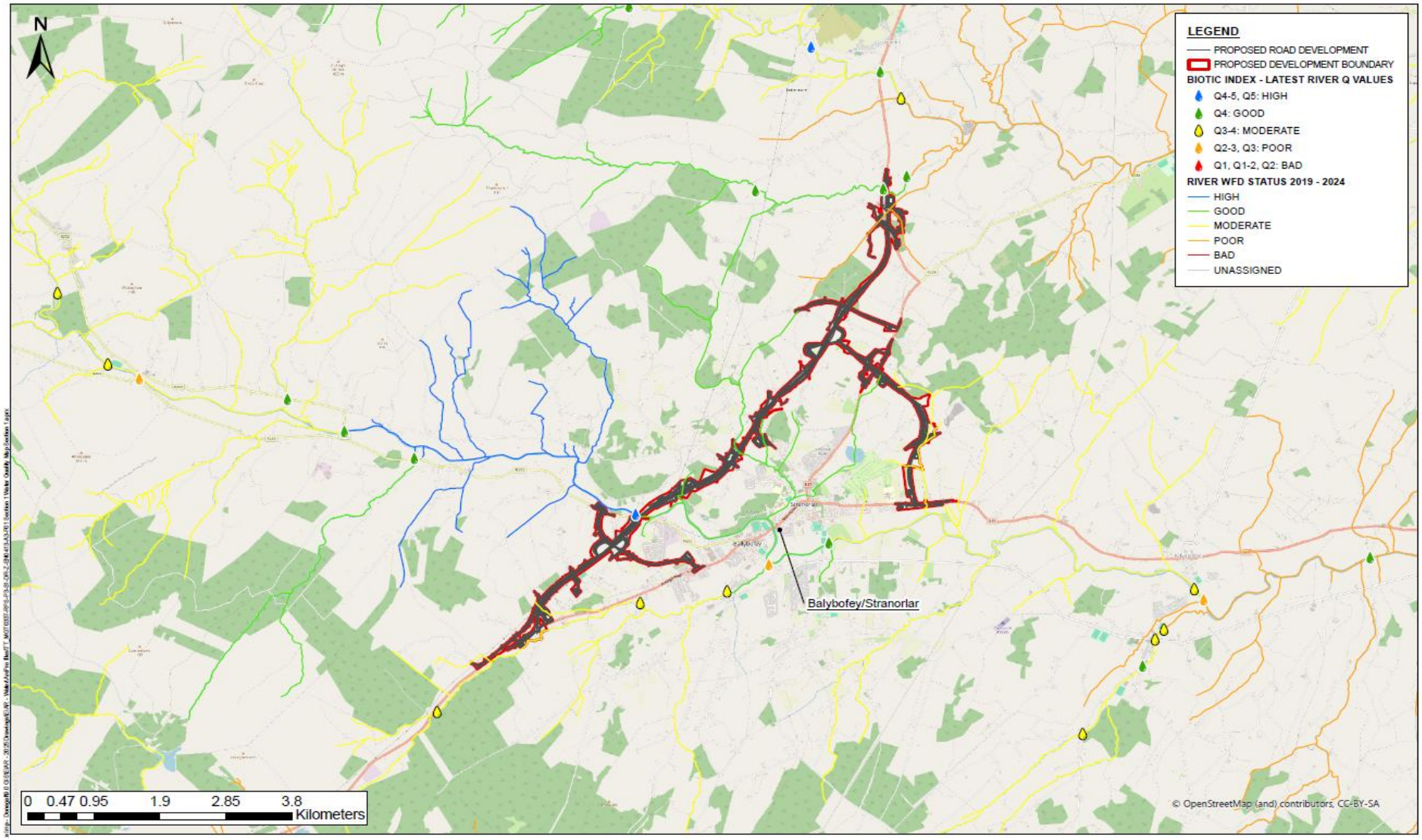

Figure 11-4: Section 1 EPA WFD Water Body Status Map (2019-2024)

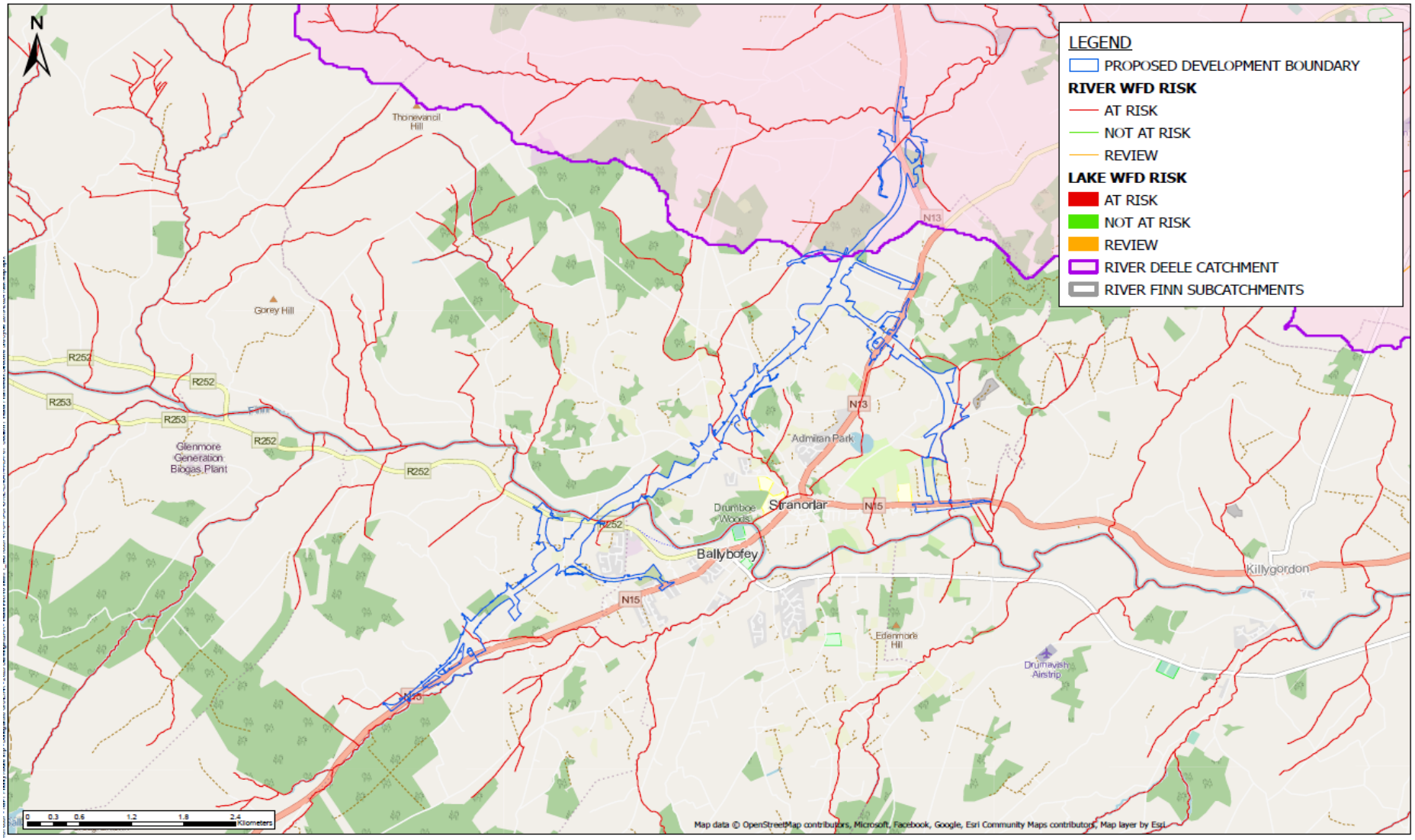

Figure 11-5: Section 1 EPA WFD Water Body Risk Map (2019-2024)

11.4.1.5 Groundwater

The hydrogeological baseline environment and impact assessment are addressed in Chapter 10: Land, Soil & Hydrogeology.

11.4.1.6 Potable Water

There are no public drinking water abstraction points (surface waters) within the scheme area. Drinking water demands for the Section 1 scheme area are currently supplied from the Lough Mourne/Meencrumlin Water Supply Scheme, the source being Lough Mourne located approximately 3 km outside of the scheme area and upstream of the proposed works on the Burn Daurnett (Figure 11-6). There are no Group Water Schemes, municipal or industrial abstraction points within the scheme area.

Information regarding ground water abstraction (where relevant), including domestic wells is provided in Chapter 10: Land, Soil & Hydrogeology.

11.4.1.7 Wastewater Discharges

Figure 11-6 illustrates the locations of discharge points from industrial and municipal sewage effluent discharges. There can be seen to be three industrial Section 4 discharge points (orange cross), one primary effluent emission point (Ballybofey-Stranorlar WWTP – green point) and five storm water overflows in the scheme area (white stars).

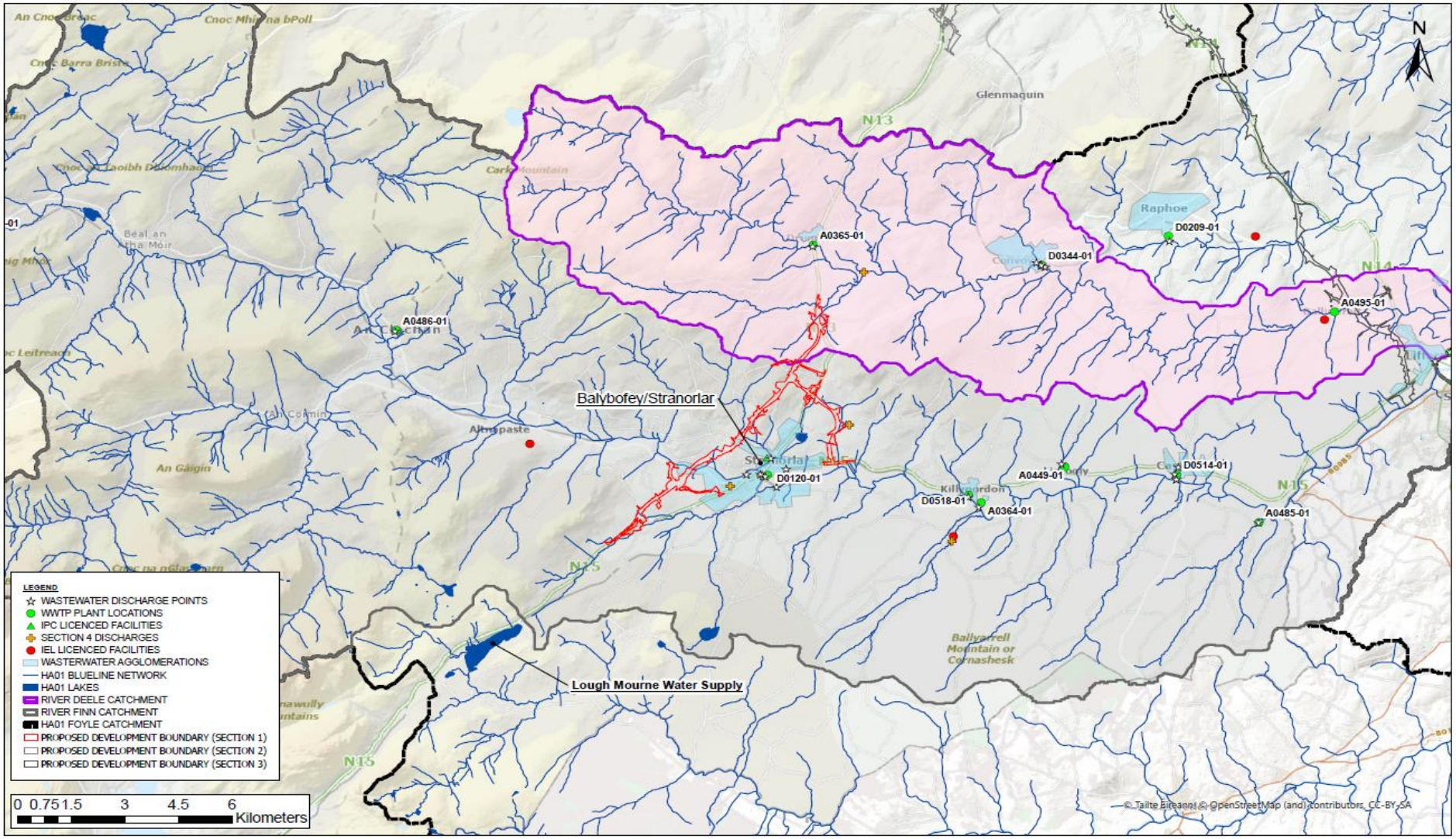

Figure 11-6: Section 1 Portable Water and WWTP Locations

11.4.1.8 Historical Drainage Features

A review of historical 6-inch mapping has revealed very little change in drainage regimes in the scheme area. One noticeable feature identified in the 6-inch mapping is a body of water just north of the Ash Meadows housing estate at Magherapaste and approximately 300 m from the Proposed Development (Figure 11-7). There is a label beside it reading “Mill Dam”. The mill dam has evidently since been abandoned and there is no evidence of any ponding at this location presently. A similar pre-existing mill dam pond is visible on 6-inch mapping near the intersection of N13 and N15. This has also been abandoned and there is no evidence of ponding at this location presently.

Figure 11-7: Location of Abandoned Mill Dams in Relation to Section 1 Proposed Development Project

11.4.1.9 Flooding

Flood risks to the Proposed Development have been investigated by reviewing all available historical flood information and any flood maps prepared for the scheme area under previous flood studies (source: www.floodinfo.ie). The flood risk posed by the Proposed Development within Section 1 has been assessed as part of this study and discussed in further detail in Section 11.6.1.

OSI Historical Mapping:

The 6-inch Cassini historical maps do not illustrate any evidence of flooding in the past in the vicinity of the Proposed Development.

OPW Flood Hazard Mapping:

The Flood Hazard Mapping Website (www.floodmaps.ie) is a record of historical flood events maintained by the OPW. The data available was reviewed in order to obtain information on recorded flood events within the scheme area. There were several instances of flooding reported in the Ballybofey/ Stranorlar area but none of these events coincide with the extents of the Proposed Development (Figure 11-8).

Table 11-16 summarises the four instances of flooding recorded within a 2 km radius. All are located downstream of the proposed crossings. The road will pass over the River Finn and through the flood extent for this waterbody.

It is apparent from the recorded flood history that the River Finn frequently floods its banks. However, there are no recorded instances of flooding at the proposed crossing. It is important to note that the area of the proposed flood crossing is less densely populated than downstream areas at Ballybofey/ Stranorlar and vulnerable receptors may be at a higher level than areas that flood so flood events may have escaped identification and reporting.

Table 11-16: River Finn Crossing - Summary of Historical Flood Events (source: FloodInfo.ie)

Flood ID	Location	Date(s) of Report(s)	Recorded date of occurrence	Frequency	Description
4188	**Trusk Rd / Townview Heights, Ballybofey**	13 January 2006	N/A	Annual	Runoff from high ground causes flooding every year after heavy rain. The road is liable to flood, and properties are affected. Surface water system is unable to cope with the volume of water.
4176	**Navenny Bridge, Ballybofey**	26 September 1985 06 February 1995 13 January 2006 26 November 2006 01 May 2005	20 September 1985- 21 September1985	Annual	River Finn overflows its banks every year after heavy rain. The road is liable to flood and can be blocked.
232 2373 2434	**Ballybofey Bridge downstream**	26 September 1985 06 February 1995		Annual	River Finn overflows its banks every year after heavy rain. The road is liable to flood and can be blocked.
12741	**St. Mary's National School, Stranorlar**	12 January 2017	05 December 2015- 06 December 2015	N/A	Flooding at St Marys NS Stranorlar Co. Donegal 5-6 December 2015. Report prepared by CFRAM consultant

The winter of 2015/2016 saw exceptional and widespread flooding due to prolonged intense rainfall in Ireland. The floods recorded across the country during the winter of 2015/2016 are believed to be the worst on record. This holds true for the River Finn catchment where the catchment experienced the highest flow ever recorded at Ballybofey hydrometric station 01043 on 15 November 2015 and the second highest flow ever recorded at the station on 5 December 2015. The return period for the two floods recorded in November (568.75 m^3/s) and December 2015 (555.42 m^3/s) have proven to be in excess of the predicted 100-year flood.

The low-lying floodplains of the River Finn and Mallaghgarry River, particularly at their confluence, generally floods every year during the winter months. The causes of flooding are due to high water levels in River Finn and the flow-backup caused in the Mallaghgarry River as a result of this.

OPW CFRAM Study and National Indicative Fluvial Mapping (NIFM):

Ballybofey/Stranorlar has been identified as an Area for Further Assessment (AFA) in the OPW PFRA in 2012. Under the Northwest -Neagh Bann CFRAM study (OPW, 2016) flood levels in all high priority watercourses (River Finn & Backlees), located within this AFA were estimated through a detailed hydrological and hydraulic modelling. Also, under the OPW National Indicative Fluvial Mapping (NIFM) Project (2020), predictive flood extent maps were produced for all watercourses with catchment area greater than 5 km^2, and for which flood maps were not produced under the National CFRAM Programme. For example, the Cloghroe river channel at the Section 1 road crossing was not modelled under the CFRAM study, however, predictive flood extent maps were prepared for this watercourse under the NIFM study.

The above studies showed that the proposed Section 1 road crosses/encroaches the 0.1%AEP flood extents at a number of locations as listed in Table 11-17. Figure 11-9 illustrates these flood extents for the current climatic condition.

Table 11-17: Section 1 Road Route- Predictive Flood Risks (CFRAM & NIFM Studies)

EPA Name	Watercourse Segment Code	Crossing/ Encroachment	Flood Risk Details
(Burn) Daurnett	01_1815	Crossing & Encroachment	Proposed tie in with the mainline 1.1 at Ch.0+200 is located in close proximity to the CFRAM study estimated 1%AEP flood extent of the (Burn) Daurnett River (between Ch. 0+200 & Ch.0+350) (CFRAM) Also proposed southern tie-in road embankment with the existing N15 road crosses the 1%AEP flood extent estimated under the NIFM study. This road crosses the stream segment 01_1026, a tributary of (Burn) Daurnett.
Finn	01_7147 01_590 01_591	Crossing & Encroachment	The main line crosses the River Finn where there is also a considerable encroachment on the CFRAM study estimated 0.1% AEP flood extents (between Ch2+350 and Ch 3+000).
Aghasheil	01_553	Crossing & Encroachment	Proposed underpass for R252 of main line crosses the Aghasheil stream while also encroaching upon the 0.1% AEP flood extents (CFRAM).
Backlees	01_186	Crossing	The mainline 1.2 crosses the Backlees stream with slight encroachment on the CFRAM study estimated 0.1% AEP flood extent. of the 0.1% of road embankment.
Mullaghagarry	01_67, 01_68	Crossing & Encroachment	A local access/link road to the primary N15 link road crosses/encroaches the CFRAM study estimated 0.1%AEP flood extents at Ch. 2+050 of primary N15 link road.
Mullaghagarry	01_776	Crossing & Encroachment	The proposed tie in road and roundabout with existing N15 crosses/encroaches upon the CFRAM study estimated 0.1%AEP flood extents (between Ch0+00 & Ch0+250).
Cloghroe 010	01_1796	Crossing & Encroachment	The NIFM shows that the proposed tie-in with the existing N13 road crosses the 1%AEP flood extents and also road embankment and roustabout is located within the 0.1% AEP extents.

SFRA, County Donegal Development Plan 2024 - 2030:

Under the County Donegal Development Plan 2024-2030 a Strategic Flood Risk Assessment (Donegal County Council, 2024a) was prepared in accordance with the requirements of “The Planning System and Flood Risk Assessment Guidelines for Planning Authorities (2009) Circular PL02/2014 (August 2014)”. In this SFRA, flood zone maps were prepared for all planning areas. These flood zones were derived from the North-Western Neagh Bann CFRAM and ICWW studies predicted flood maps (Figure 11-10). Much of Section 1 is located in Flood Zone C, however the low-lying floodplains of the River Finn and its tributaries are in Flood Zone A & B. The proposed road embankments will encroach these flood prone areas at the relevant bridge crossings. Also based on the NIFM map, the proposed road embankment will also encroach the Cloghroe River floodplain in the vicinity of its intersection with N13. This river is a tributary of River Deele. Further to this, the proposed N15 link road will also encroach the River Finn and Mullaghagarry River’s floodplains, at its tie-in location with N15 at Treanamullin (east of Stranorlar).

A detailed flood risk assessment for all of the above-mentioned flood affected river crossings in Section 1 was carried out. The flood risk assessment report is included in Appendix C11.01.

Further to this, Donegal County Council in conjunction with OPW are currently implementing the Ballybofey / Stranorlar Flood Relief Scheme. This project is currently at Scheme Development Stage (Stage 1) (Office of Public Works., 2021).

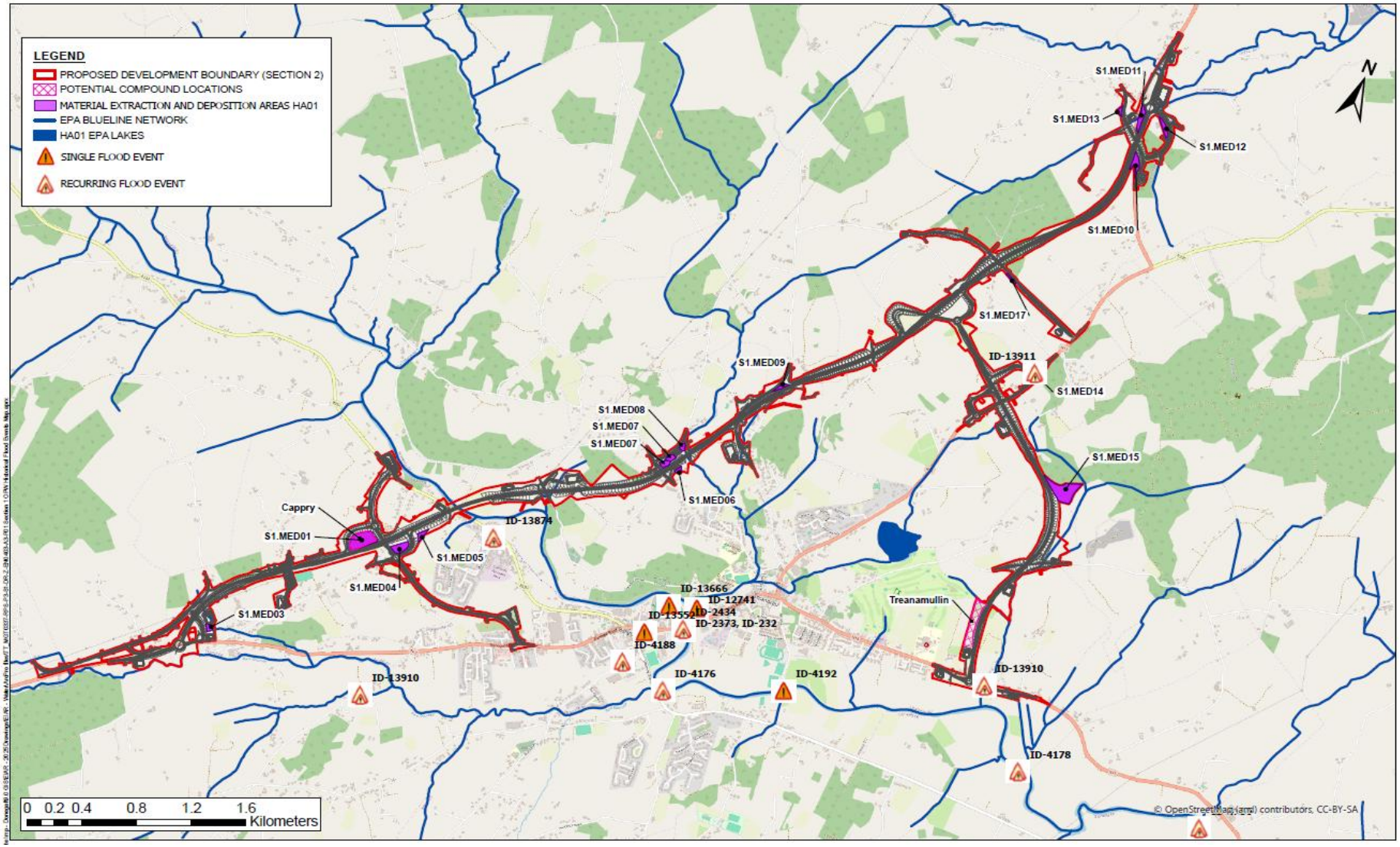

Figure 11-8: Section 1 Historical Flood Points

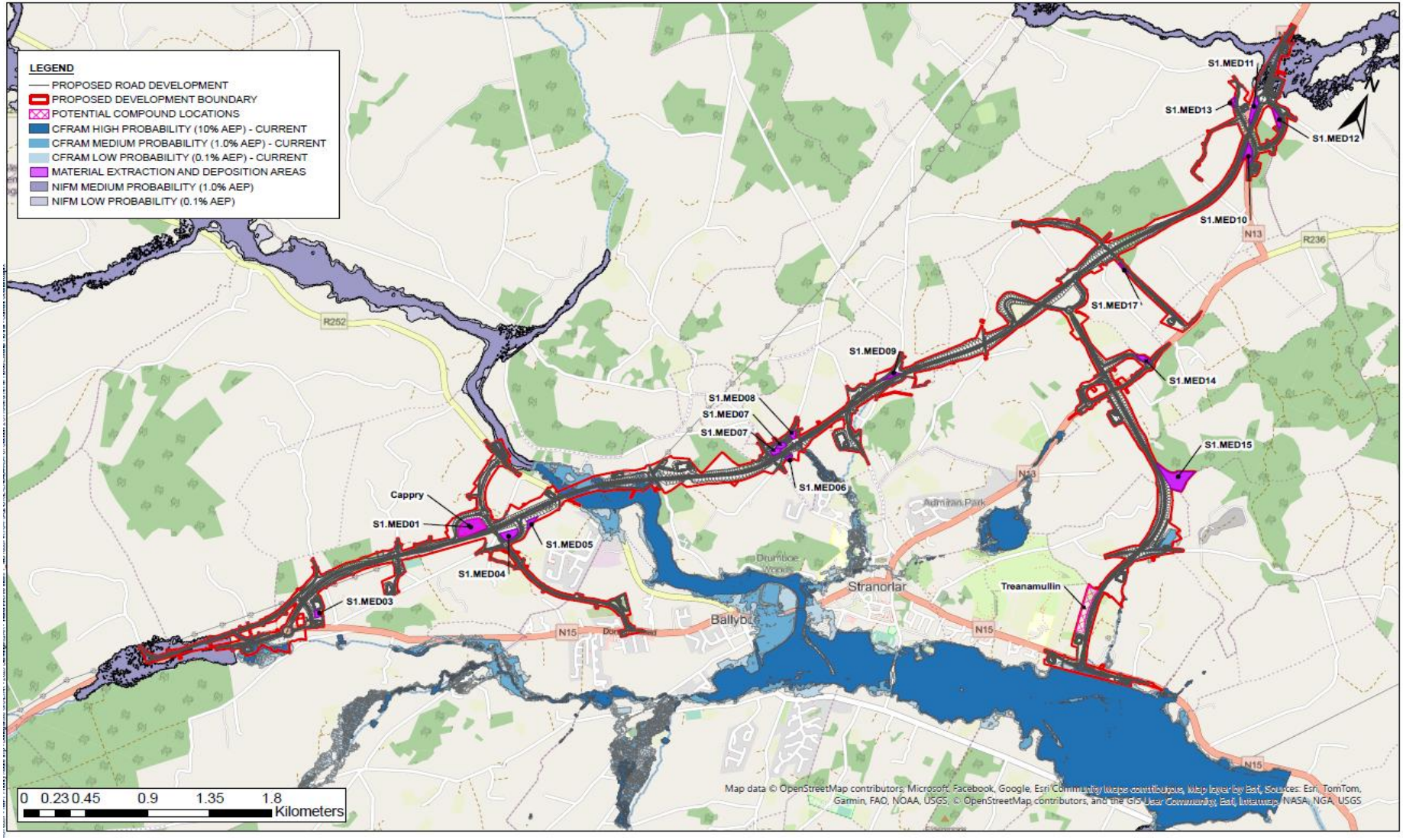

Figure 11-9: CFRAM Flood Extent Map (Fluvial – Current Scenario

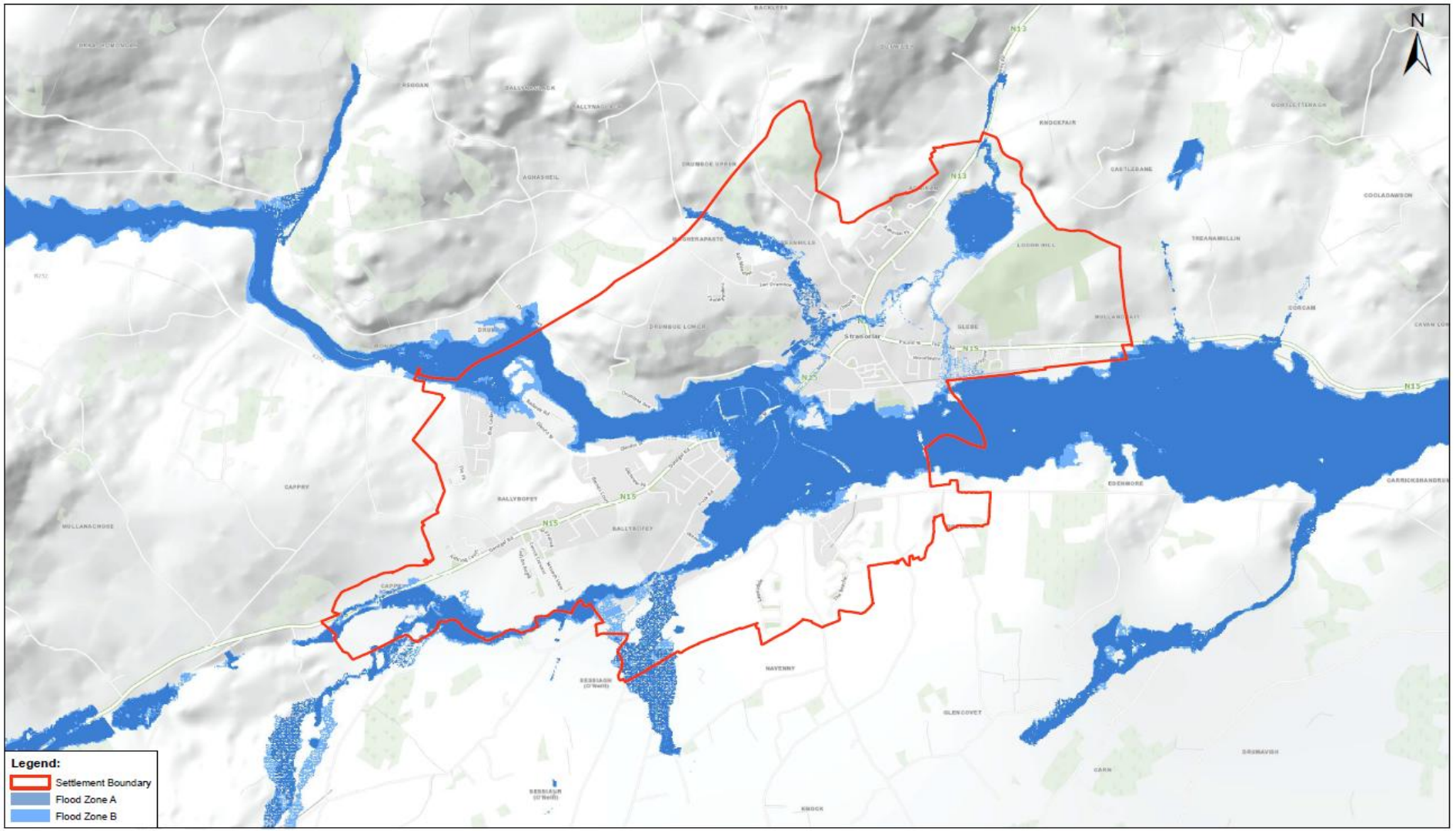

Figure 11-10: Section 1 Flood Zone Map (County Donegal Development Plan SFRA, 2024-2030)

11.4.2 Section 2 Existing Environment

11.4.2.1 Catchments

The Section 2 Proposed Development area lies within the Lough Swilly Catchment and forms part of the National Hydrometric Area – 39. The main surface water features potentially impacted by the Proposed Development include the River Swilly, River Pluck (Leslie Hill Stream) and their tributaries, as well as the Swilly Estuary.

The River Swilly is the major river of the greater Lough Swilly catchment (HA 39) and receives flows from a number of tributaries including the Sprack, Corravaddy Burns and the Knocknamona watercourse. The Swilly River catchment is fairly mixed in land coverage with forested land, pasture, peat bog and the urban area of Letterkenny. The tributaries which enter the Swilly emanate from the hills surrounding Letterkenny to the north and south. Some of these tributaries pick up a significant amount of urban drainage along the way to their discharge points into the Swilly. The River Swilly Sub Catchment (Swilly_SC_010) is a medium sized catchment with an area of 97 km^2 upstream of the proposed bridge crossing at Letterkenny.

The Isle Burn stream catchment is also located within hydrometric area 39 – Lough Swilly. The stream conveys flows from approximately 54.57 km^2 of upstream land areas at the proposed footbridge location. The catchment is predominantly underlaid by a mixture of poorly drained and deep well-drained metamorphic tills with a BFI value of 0.5141.

Table 11-18 presents the PCDs for the River Swilly and Isle Burn at the proposed bridge crossings. (ref. OPW, FSU, 2009).

Table 11-18: Section 2 FSU Catchment Characteristics

PCDs	River Swilly	Isle Burn
Area (km^2):	96.761	54.567
Standard Average Annual Rainfall (SAAR) (mm):	1,568.43	1,110.34
FARL:	1	1
BFISOIL	0.3188	0.5141
Drainage Density (DRAIND) km per km^2:	2.081	1.58
Channel Flood Slope S1085 (m/km):	8.1566	11.487
ARTDRAIN^2	0.0606	0.0212
URBEXT	0.0422	0.0012

An overview of the watercourses potentially impacted by Section 2 are presented in Table 11-19 and illustrated in Figure 11-11. The extent of the Lough Swilly catchment area and associated tributaries catchment areas and hydrometric gauge locations are illustrated in Figure 11-12. EIAR Drawing 9B.02 in Volume D: Book of Drawings (Watercourse Survey Locations – Section 2) contains higher resolution maps of EPA watercourse and water body names, including aquatic biodiversity survey site locations on each that underpinned the identification of water receptor sensitivity. See Appendix C9B.01 for detailed aquatic survey site habitat and summary data and Appendix C9B.02 for representative images of aquatic ecology survey points on watercourses.

Table 11-19: Section 2 Overview of Potentially Impacted Watercourses

EPA Name	EU River Waterbody Code	Watercourse Segment Code	Relevant Aquatic Ecology Survey Site(s) Ref.	WFD Catchment	WFD Sub-Catchment	WFD River Water Body Name
Drumany	IE_NW_39S020300	39_1545	W2-01	Lough Swilly	Swilly_SC_010	Swilly (Donegal)_010
Dromore Upper	IE_NW_39S020300	39_1021	W2-02	Lough Swilly	Swilly_SC_010	Swilly (Donegal)_010
Dromore Upper	IE_NW_39S020300	39_1544	W2-03, W2-04	Lough Swilly	Swilly_SC_010	Swilly (Donegal)_010
Bunnagee	IE_NW_39S020300	39_1288	W2-06	Lough Swilly	Swilly_SC_010	Swilly (Donegal)_010
Unknown	IE_NW_39S020300	39_2934	W2-07	Lough Swilly	Swilly_SC_010	Swilly (Donegal)_010
Dromore 39	IE_NW_39S020300	39_2954	W2-23	Lough Swilly	Swilly_SC_010	Swilly (Donegal)_010
Drumgreggan	IE_NW_39S020300	39_1268	W2-09	Lough Swilly	Swilly_SC_010	Swilly (Donegal)_010
Unknown	IE_NW_39S020300	39_225	W2-08	Lough Swilly	Swilly_SC_010	Swilly (Donegal)_010
Maghera_More 39	IE_NW_39L050660	39_413	W2-14	Lough Swilly	LeslieHill[Stream]_SC_010	Leslie Hill Stream_020
Trimragh	IE_NW_39L050660	39_412	W2-13	Lough Swilly	LeslieHill[Stream]_SC_010	Leslie Hill Stream_020
Maghera_More 39	IE_NW_39L050660	39_576	At confluence of W2-13, W2-14	Lough Swilly	LeslieHill[Stream]_SC_010	Leslie Hill Stream_020
Leslie Hill (Stream)	IE_NW_39L050660	39_741	W2-15	Lough Swilly	LeslieHill[Stream]_SC_010	Leslie Hill Stream_020
Farsetmore	IE_NW_39S020300	39_2476	W2-10, W2-11, W2-12	Lough Swilly	Swilly_SC_010	Swilly (Donegal)_010
Coaghmill	IE_NW_39S020300	39_2151	W2-19	Lough Swilly	Swilly_SC_010	Swilly (Donegal)_010
Swilly 39	IE_NW_220_0100	39_2718	W2-18	Lough Swilly	Swilly_SC_010	Swilly (Donegal)_010
Swilly 39	IE_NW_220_0100	39_2724	175 m downstream W2-18	Lough Swilly	Swilly_SC_010	Swilly (Donegal)_010

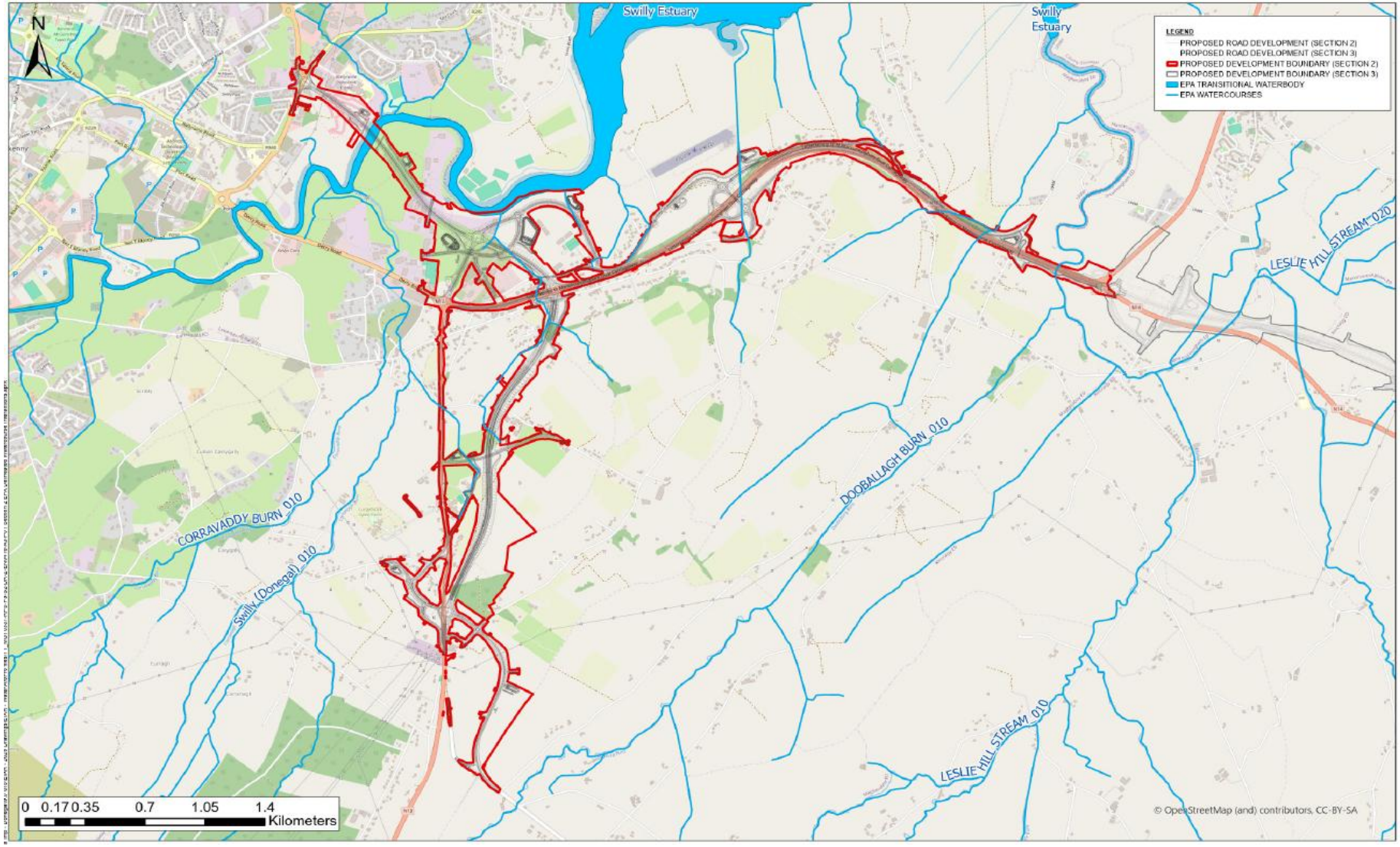

Figure 11-11: Section 2 EPA Delineated Watercourse Interactions

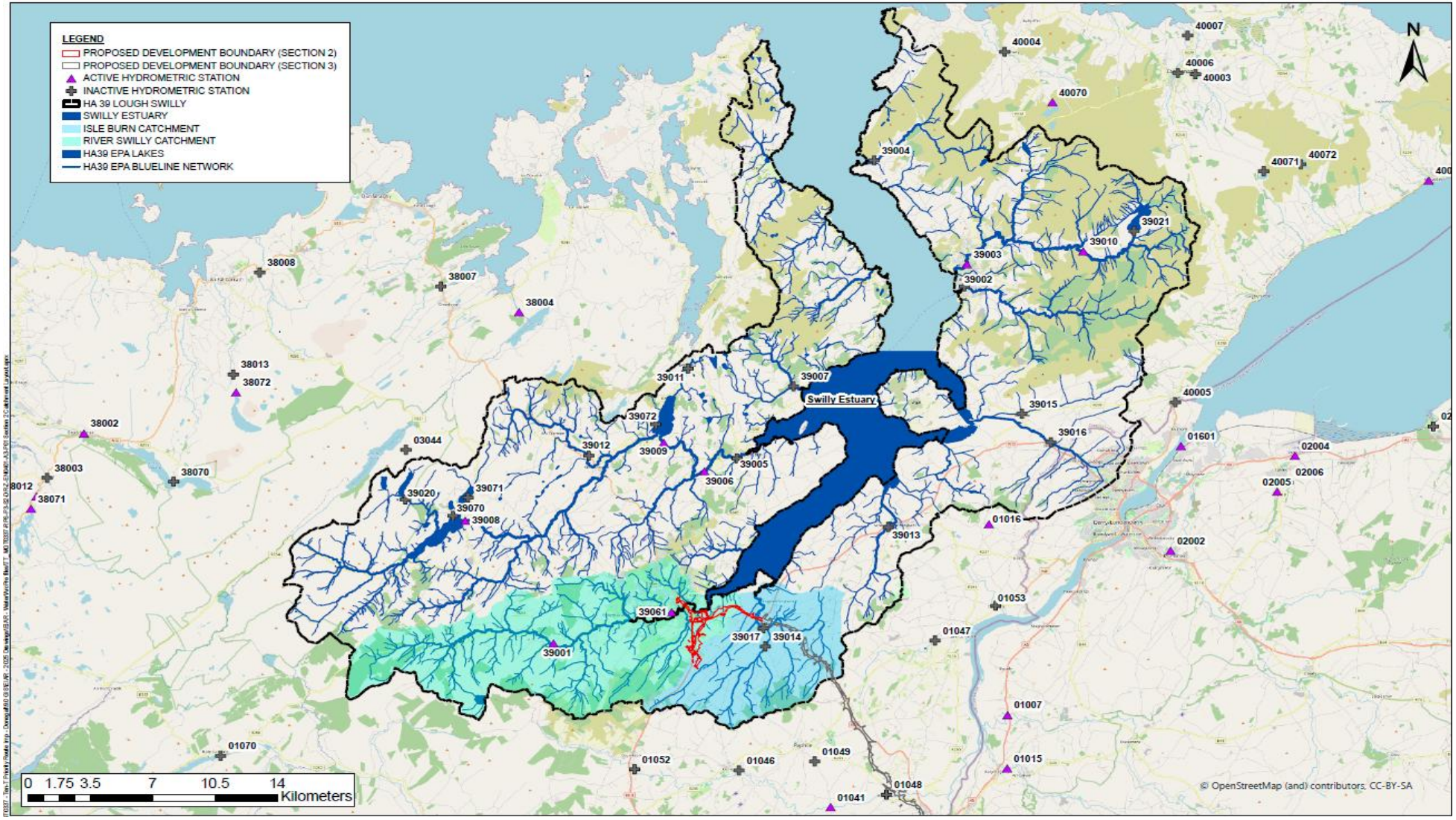

Figure 11-12: Section 2 Surface Water Features, Catchments (FSU 2022) and Hydrometric Gauge Locations

11.4.2.2 Ecological Importance of Hydrological Sites

See Chapter 9B: Biodiversity – Aquatic, Table 9B.20 for ecological importance of watercourses relevant to the Section 2 Proposed Development, including International and national designations. The data fed into the assigning of hydrological importance for the current assessment as per Table 11-1, above.

11.4.2.3 Hydrology

The scheme area lies within the Lough Swilly Catchment and forms part of the National Hydrometric Area – 39. The main surface water features potentially impacted by the Proposed Development include the River Swilly, River Pluck (Leslie Hill Stream) and their tributaries, as well as the Swilly Estuary.

As part of the North-western - Neagh Bann CFRAM Study, a detailed hydrology report was prepared in 2015 for the UoM 01 (Donegal)[3]. Letterkenny was one of 26 AFAs identified during the Preliminary Flood Risk Assessment process in UoM 01 for further hydrological and hydraulic analysis. The Letterkenny AFA is in east Donegal and is affected by the lower reaches of the river Swilly, its adjoining tributaries, and the Swilly Estuary. Design flows of various return periods were calculated along the river Swilly and its tributaries using best practice guidance for Irish catchments generally as outlined in the FSU (FSU, OPW, 2009) and supplemented with other methodologies where these were considered more appropriate.

Table 11-20 provides a summary of catchment characteristics and estimated design flows for all watercourses that are to be crossed by the proposed Section 2. Figure 11-13 illustrates the locations of these watercourses. These design flows have been estimated as part of this project using the FSU and FSR (Natural Environment Research Council, 1975) recommended methodologies.

[3]North Western – Neagh Bann CFRAM Study – UoM 01 Hydrology Report, RPS 2015 (http://www.cfram.ie/otherprojects/IBE0700Rp0006_UoM01%20Hydrology%20Report_F02.pdf)

Table 11-20: Section 2 Catchment Characteristics and Design Flows of Potentially Impacted Watercourses

EPA River Name	Watercourse Segment Code	Culvert Ref	Chainage	AREA (km^2)	SAAR (mm)	S1,085 (m/km)	BFI	Estimated Flows (m^3/s)	
								Qmed	Q100 (incl. 20% CCA)
Drumany	39_1545	S2-CUL13	Ch.1+411 (Mainline 2.2)	0.34	1,215.9	N/A	N/A	N/A	0.616
Dromore Upper	39_1544	S2-CUL16, CUL-17 & CUL18	Ch.1+630 (CUL 18 -Mainline 2.5)	1.24	1,137.7	37.06	0.5092	0.8834	4.24
Un named	39_2934	S2-CUL20	Ch.0+150 (LX-2010)	1.33	1,137.7	37.06	0.5092	0.9425	4.52
Dromore 39	39_2954	S2-CUL27	Ch.0+325 (LX-2005)	0.08	1,215.9	N/A	N/A	N/A	0.181
Dromore Upper & Un-named	39_2021 & 39_225	S2-CUL28	Ch.0+695 (LX-2005)	0.35	1,215.9	N/A	N/A	N/A	0.743
Maghera_More 39	39_413	S2-CUL34	Ch.2+928 (Mainline 2.4)	1.02	1,136.1	16.08	0.562	0.5463	2.50
Trimragh	39_412	S2-CUL33	Ch.2+635 (Mainline 2.4)	0.23	1,215.9	N/A	N/A	N/A	0.482
Leslie Hill (Stream)	39_741	Isle Burn Foot Bridge	Ch.3+400 (Mainline 2.4)	54.57	1,110.3	11.487	0.5141	17.38	39.61
Farsetmore	39_2476	S2-CUL29, CUL30, CUL31 & CUL32	Ch. 0+128 (CUL 32 L-5494 Connector)	1.54	1,135.9	43.85	0.577	1.0034	7.54
Coaghmill	39_2151	S2-CUL10 & CUL11	Ch.0+160 (CUL 11 L-5784 Connector)	0.20	1,215.9	N/A	N/A	N/A	0.48
Swilly Estuary	39_2718	River Swilly Bridge	Ch.03+400 (Mainline 2.4)	96.76	1,568.4	8.1566	0.3188	71.86	181.09

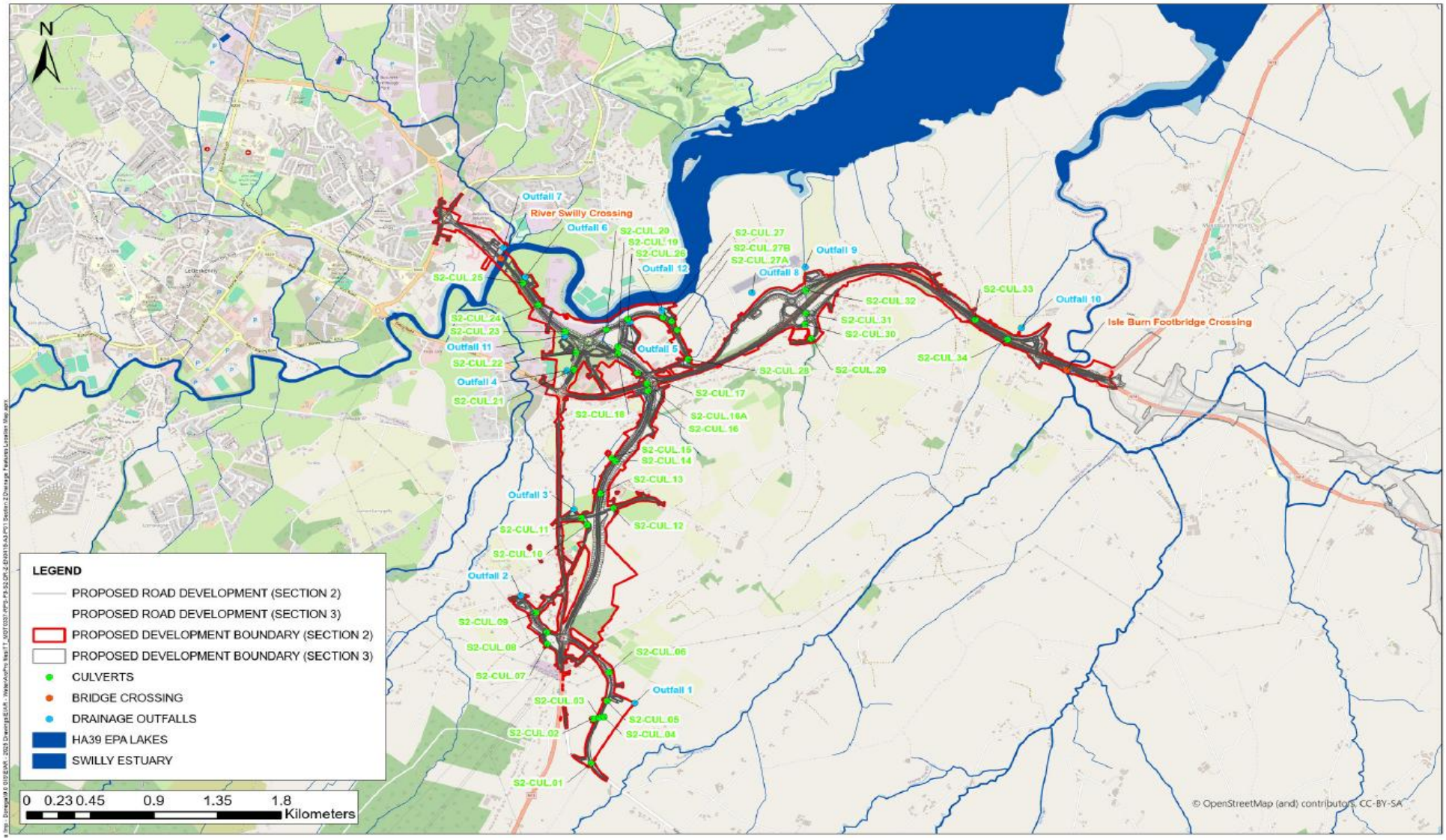

Figure 11-13: Section 2 Locations of Culverts, Bridges and Proposed Stormwater Outfalls

11.4.2.4 WFD Status and Q-values

WFD water body status and risk category for watercourses within the Proposed Development project are provided in the WFD Compliance Evaluation in Appendix C11.04. Water body status and risk category for the current reported period (2019-2024) are illustrated in Figure 11-14 and Figure 11-15, respectively.

River Q-values

Table 11-21 presents EPA Q-value monitoring data for River Swilly, Corravaddy Burn, Leslie Hill Stream (Isle Burn) and Dooballagh Burn in the vicinity of Section 2. Chapter 9B: Biodiversity – Aquatic, Appendix C9B.01 and C9B.03 contain additional Q-value data from aquatic ecology field studies.

Table 11-21: EPA Q-Value Data – River Swilly, Corravaddy Burn,Leslie Hill Stream and Dooballagh Burn

EPA Code	Station Name	2016	2019	2023	2025
39S020190	River Swilly – Br. at Newmills	4-5	4	4	4
39C030250	Corravaddy Burn – Br. near Bunnagee	3	3-4	4	4
39L050600	Leslie Hill Stream – Br.at Leslie Hill	2-3	4	4	4
39D020110	Dooballagh Burn - 100m d/s Foundry Bridge	4	4	~	4
39D020200	Dooballagh Burn - Br. At Pluck Mill	4	4	~	4

Swilly Estuary

The Swilly Estuary is a Transitional Waterbody (EPA code: IE_NW_220_0100) monitored by the EPA, currently assigned ‘poor’ status (EPA data 2019-2024) based on phytoplankton (P), general physicochemical conditions(M), nutrient and phosphorus conditions (H) (EPA Envision Maps, Accessed November 2025). It is categorised as “At-Risk” of not obtaining good status by 2027.

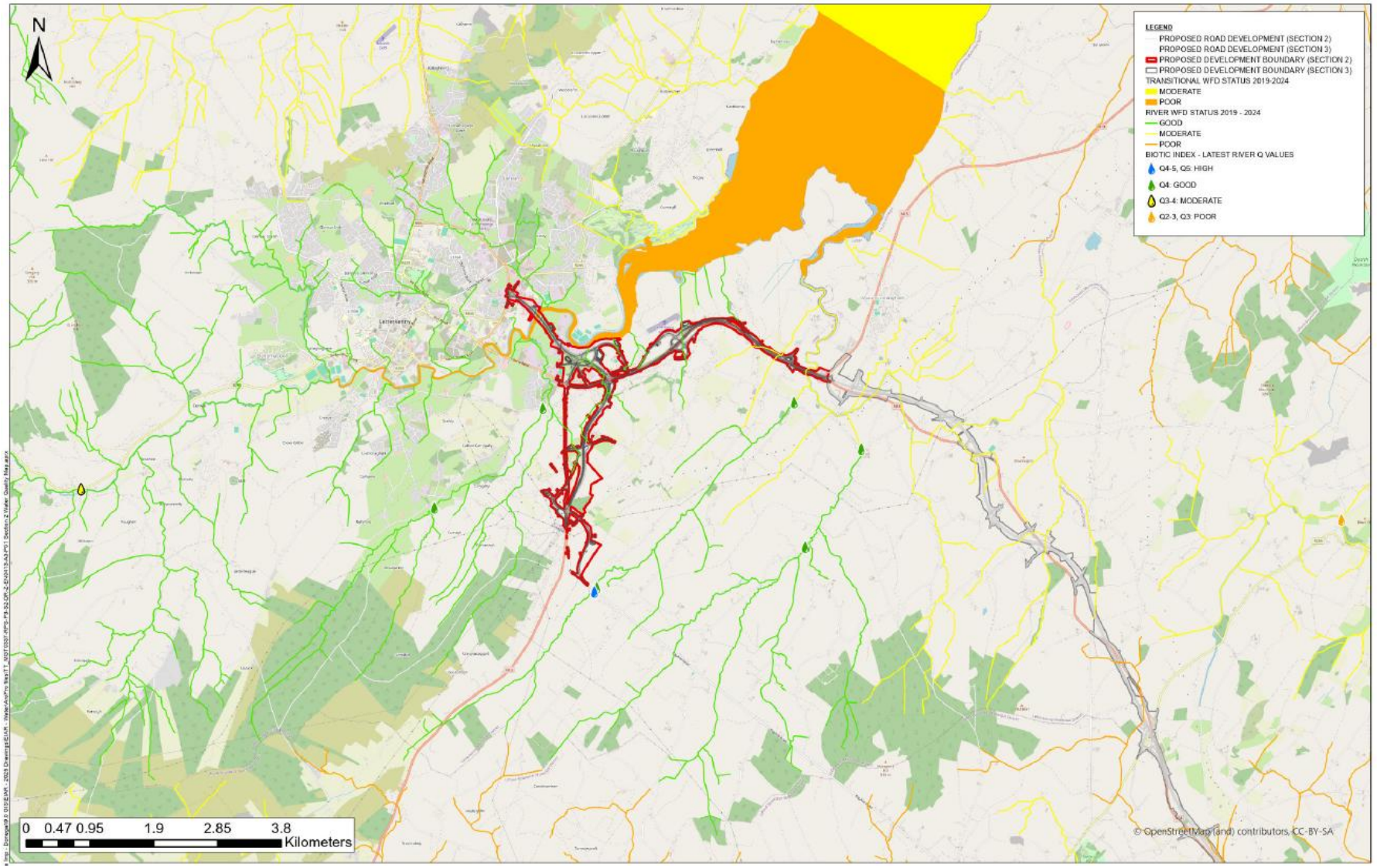

Figure 11-14: Section 2 EPA WFD Water Body Status Map (2019-2024)

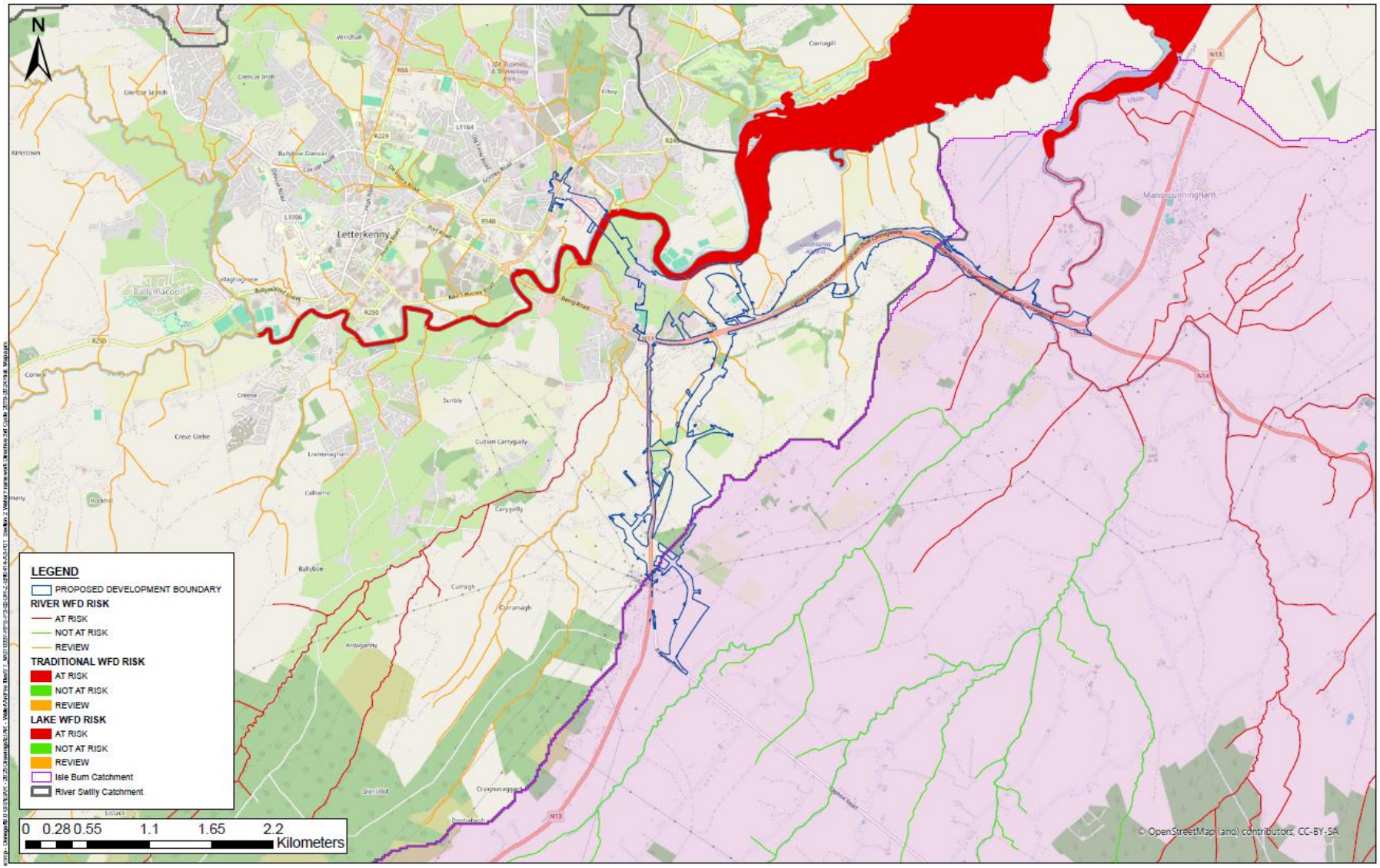

Figure 11-15: Section 2 EPA WFD Water Body Risk Map (2019-2024)

11.4.2.5 Groundwater

The hydrogeological baseline environment and impact assessment are addressed in Chapter 10: Land, Soil & Hydrogeology.

11.4.2.6 Potable Water

There are no public drinking water abstraction points (surface waters) within the scheme area. There are no Group Water Schemes, municipal or industrial abstraction points within the scheme area (Figure 11-16).

The PWS for the Letterkenny area is sourced from Lough Salt and Lough Greenan Mourne located to the northwest of the scheme area. The boreholes supplying Manorcunningham PWS are located approximately 900 m to the east of the of the Proposed Development.

Further information regarding abstraction points including the domestic wells are provided in Chapter 10: Land, Soil & Hydrogeology.

11.4.2.7 Wastewater Discharges

Figure 11-16 below illustrates the locations of discharge points from industrial and municipal sewage effluent discharges. There can be seen to be two industrial section 4 discharge points (orange cross) and two primary effluent emission point (Letterkenny and Manorcunningham WWTPs - green point) and one storm water overflow in the scheme area (white stars).

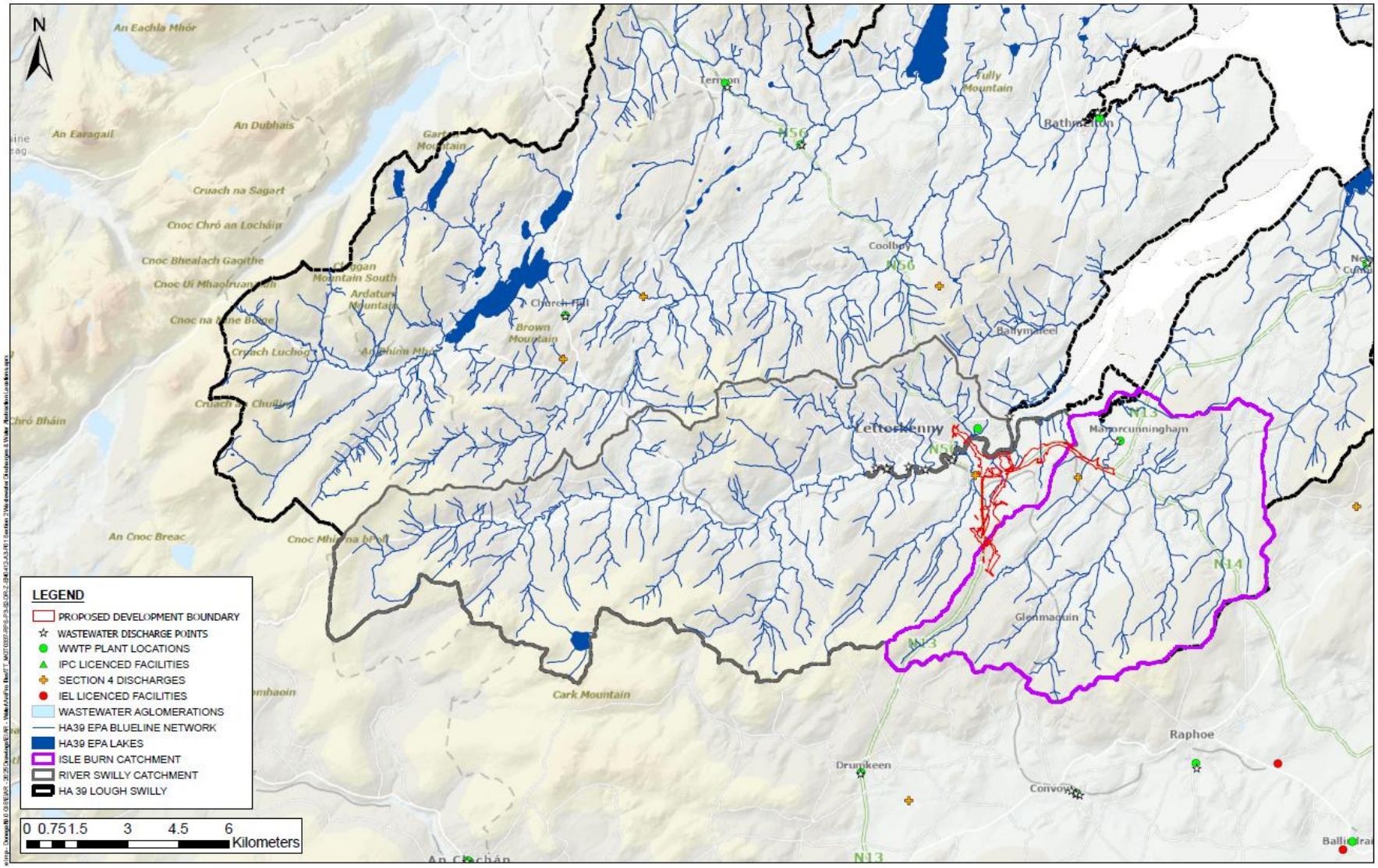

Figure 11-16: Section 2 Potable Water and WWTP

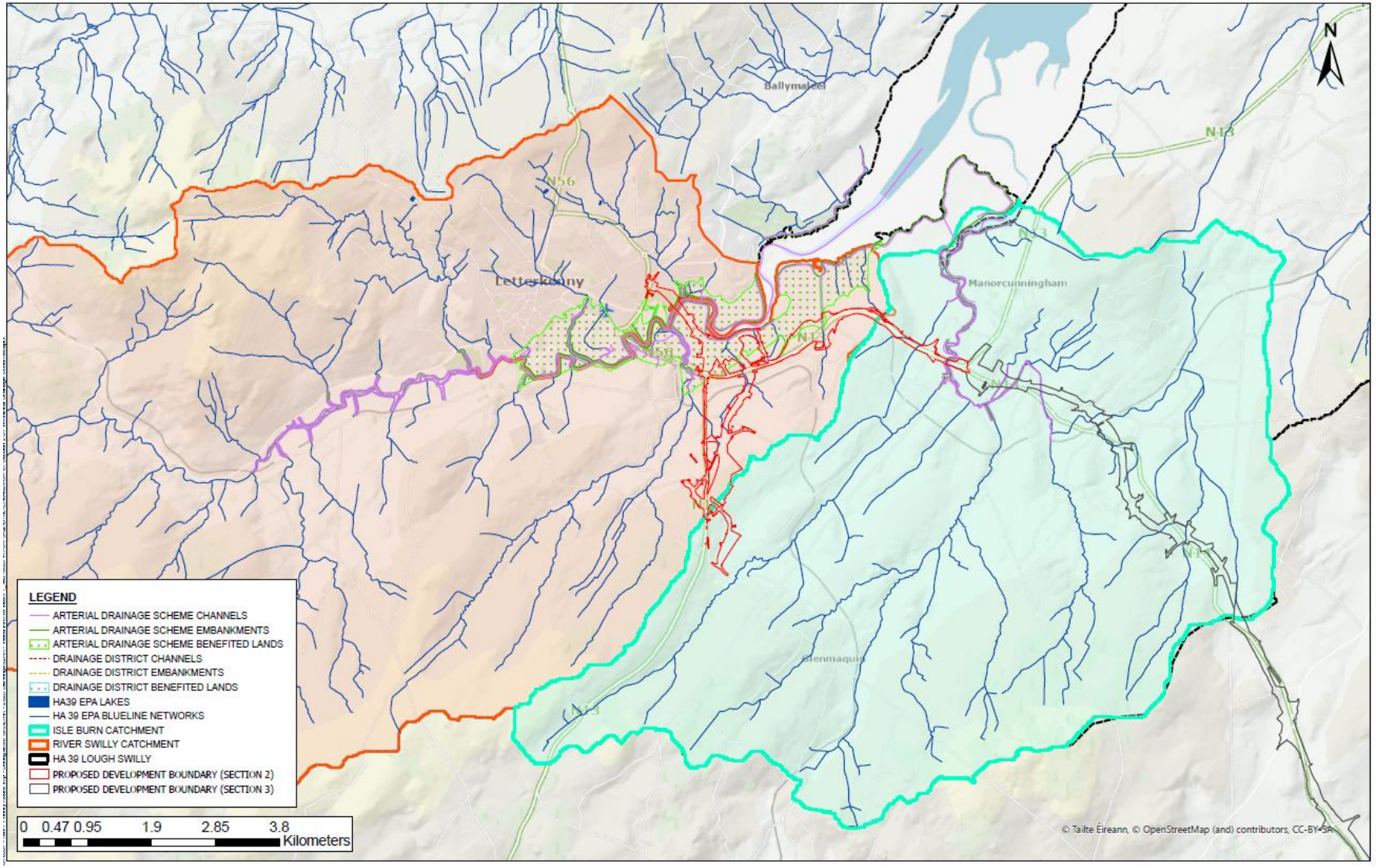

Figure 11-17: Section 2 Arterial Drainage System

11.4.2.8 Flooding

Flood risks to the Proposed Development have been investigated by reviewing the available historical flood information and any flood maps prepared for the scheme area under previous flood studies (source: www.floodinfo.ie). The flood risk posed by the Proposed Development within Section 2 has been assessed as part of this study and discussed in further detail in Section 11.6.2.

OSI Historical Mapping

The OSI 6-inch Cassini and 25 inch historical maps do not illustrate any evidence of flooding in the past in the vicinity of the Proposed Development. It appears that the 'Ordinary Tide' historically flowed as far as Milk Isle. The map illustrates a relatively intricate network of open drains that outfall to the River Swilly and Corravaddy Burn. Some of these drains still exist while some have been combined and redirected to other locations (Figure 11-18). The 25-inch map shows evidence of flood defence berms along the riverbank and lands "liable to floods". The map also shows the location of the highest point to which ordinary tides flow. This would indicate that water levels in the river may be tidally affected and should be considered in any hydraulic design.

OPW Flood Hazard Mapping

The Flood Hazard Mapping Website (www.floodmaps.ie) is a record of historical flood events maintained by the OPW. The data available was reviewed to obtain information on recorded flood events within the scheme area. There are two instances of previous recurring flood events recorded in the immediate vicinity of Section 2. There are a further three instances of historical flooding recorded upstream of the Shell Bridge on the Corravaddy Burn and a further two instances of previous flooding recorded upstream on the River Swilly These are summarized in Table 11-22 and are illustrated in Figure 11-19.

The recorded flood history is that the River Swilly and Corravaddy Burn have frequently flooded their banks in the past. There is a detailed assessment of historical flood events included in the North Western - Neagh Bann CFRAM Study UoM 01 Hydraulics Report (RPS Group, 2017) as part of the hydraulic model calibration and verification. The River Swilly, Isle Burn/Leslie Hill Stream and Swilly Estuary are part of OPW Swilly Embankments drainage scheme (Office of Public Works., 2020).

OPW CFRAM Study and NIFM

Letterkenny has been identified as an Area for Further Assessment (AFA) in the OPW PFRA in 2012. Under the Northwest -Neagh Bann CFRAM study (RPS Group, 2017) flood levels in all high priority watercourses (River Swilly and its tributaries), located within this AFA were estimated through a detailed hydrological and hydraulic modelling. Also, under the OPW (2020), predictive flood extent maps were produced for all watercourses with catchment area greater than 5 km^2, and for which flood maps were not produced under the National CFRAM Programme. For example, the Isle Burn river channel at the proposed Section 2 road crossing was not modelled under the CFRAM study, however, predictive flood extent maps were prepared for this watercourse under the NIFM study.

The above studies showed that the proposed Section 2 crosses/encroaches the 1% AEP & 0.1% AEP flood extents at several locations as listed in Table 11-23. Figure 11-20 illustrates these flood extents for the current climatic condition.

ICPSS (2013)/ Irish Coastal Wave Water Study (2018):

The River Swilly Estuary is tidally impacted and was modelled under the Irish Coastal Protection Strategy Study (ICPSS, OPW, 2013). This model was updated in 2018 under the Irish Coastal Wave and Water Level Modelling Study (ICWWS, OPW, 2018). Figure 11-21 illustrates the 0.5% AEP and 0.1%AEP tidal flood extents (current scenario) for River Swilly Estuary. It can be seen from this flood map both the River Swilly and Isle Burn floodplains and much of the Bonagee junction are liable to flooding for 0.5%AEP tidal event.

Table 11-22: River Swilly Crossing - Summary of Historical Flood Events (source: FloodInfo.ie)

Flood ID	Location	Date(s) of Report(s)	Recorded Date of Occurrence	Frequency	Description
4036	Milk Isle/Bonagee	11 January 2006	N/A	Annual	A combination of low-lying land and a stream overflowing its banks every year due to heavy rain and high tides. The road is liable to flood, and properties are affected. The Halting site is also prone to flooding. Area affected is from the Port Road roundabout to the Dry Arch roundabout
552	Navenny Bridge, Ballybofey	01 December 1999 21 Decemnber1999	November 1999 05 July 1999 11 September1999 24 September1999	Annual	Flooding of back drain at Bonagee – has occurred on numerous occasions. Flooding on main Derry- Letterkenny road at Bonagee roundabout and on the minor road at Bonagee. Believed to be caused by insufficient storage in drain network when high tides occur during periods of high rainfall.
4478	Letterkenny Area (notably houses adjacent to Clanree Hotel)	October 2002	N/A	N/A	Letterkenny Localised Flood Study, mentions possibility that flooding is due to construction of Holiday Inn (Clanree) hotel.
4477	UNIFI Factory	October 2002	N/A	N/A	Letterkenny Localised Flood Study refers to flooding at Lisnenan Road. Undersized culvert and trash screen blocking causes flooding.
4038	Bunbeg	11 January 2006	N/A	Annual	A combination of low-lying land and a stream overflowing its banks every year due to heavy rain and high tides.
4037	Drumnahoagh	11 January 2006 26 November 2006	N/A	Annual	▪ Low lying land floods every year through a combination of heavy rain and high tides. ▪ Port Bridge area on N14 due to tidal influence – infrequent.
4039	Neil T Blaney Road	11 January 2006 26 November 2006	N/A	Annual	A combination of low-lying land and a stream overflowing its banks every year due to heavy rain and high tides. Areas either side of the Neil T. Blaney road are flooded

Table 11-23: Section 2 Road Route- Predictive Flood Risks (CFRAM & NIFM Studies)

EPA Name	Watercourse Segment Code	Crossing/ Encroachment	Flood Risk Details
Drumany	39_1545	Crossing & Encroachment	Proposed N13 road adjacent to Dromore junction (between Ch.1+900 and 2+100) encroaches into the CFRAM study estimated 1% AEP flood extent.
Dromore Upper	39_1544	Crossing & Encroachment	Some roads associated with the Bonagee and Dromore junctions are located within the 1% AEP flood extents of the River Swilly and the Dromore Upper Stream (CFRAM).
Bonagee & Unknown	39_12 and 39_2934	Crossing & Encroachment	Some roads associated with the Bonagee junction are located within the 1% AEP flood extents of the River Swilly and the Bonagee stream (CFRAM).
Dromore 39	39_2954	Crossing & Encroachment	The LX-2,300 Tie-in road, east of Bonagee junction encroaches the Dromore and River Swilly 1%AEP flood extents (CFRAM).
Dromore Upper & Unknown	39_1021 & 39_225	Crossing	These river segments in the vicinity of the Proposed Development were not identified as liable to flooding under the CFRAM study. However, the 39_225 segment is shown to be liable to flooding under the 0.1%AEP flood event.
Drumgreggan	39_1268	Encroachment	The proposed link road west of the Trimragh Interchange encroaches to the low-lying floodplain of this Drumgreggan stream channel (between Ch. 0+450 and Ch. 0+710). However, this was identified at flood risk in the CFRAM study.
Maghera_More/ Trimragh	39_413/39_576/39_412	Crossing & Encroachment	The proposed N13 road (between Ch. 2+850 & Ch. 3+000) encroaches on the 1% AEP flood extents of the Maghera More and Trimragh streams.
Leslie Hill (Stream)	39_741	Crossing & Encroachment	The proposed N13 road (between Ch.3+350 & Ch. 3+450) encroaches on the 1% AEP flood extents of this stream.
Farsetmore	39_2476	Crossing & Encroachment	The proposed link road north of the Trimragh Interchange encroaches to the low-lying floodplain of the River Swilly and Farsetmore stream 1%AEP flood extents (CFRAM Study).
Swilly 39 & Corravaddy (Burn)	39_2718/ 39_2724	Crossing & Encroachment	Much of the proposed Bonagee Junction and the Swilly River Bridge approach road are located within the 1%AEP floodplains of River Swilly and Carravaddy River.

SFRA, Letterkenny Local Area Plan 2022

SFRA for the Letterkenny Local Area Plan 2022 was prepared in accordance with the requirements of The Planning System and Flood Risk Assessment Guidelines for Planning Authorities (2009) Circular PL02/2014 (August 2014). The SFRA provides an assessment of all types of flood risk within the Letterkenny area and provides assistance to Donegal County Council (DCC) to make informed strategic land-use planning decisions and formulate flood risk policies. A Stage 1 Flood Risk Identification was undertaken to identify any flooding or surface water management issues related to Letterkenny that may warrant further investigation. As part of this stage the best available data at the time of preparation was acquired from the OPW North Western CFRAM Study. The North Western CFRAM has generated flood zone mapping which has been deemed suitable as a Stage 2 Initial Flood Risk Assessment. The SFRA examines the Flood Zones A, B and C identified in the North Western/Neagh Bann CFRAMs study with respect to the management of flood risk for development in respect of the Letterkenny land use zoning map.

A detailed flood risk assessment for all of the above-mentioned flood affected river crossings along Section 2 of the Proposed Development was carried out. Appropriate mitigation measures were proposed to deal with any potential flood risks to adjacent lands and properties. A copy of the detailed flood risk assessment report is included in Appendix C11.02.

Further to this, Donegal County Council in conjunction with OPW are currently implementing the Letterkenny Flood Relief Scheme. Donegal County Council has commenced a pilot data collection phase for the Letterkenny Flood Relief Scheme, ahead of appointing a consultant to progress the project.

Figure 11-22 illustrates the flood zones in Section 2 as extracted from the Strategic Flood Risk Assessment (SFRA), –Letterkenny Local Area Plan (2022):

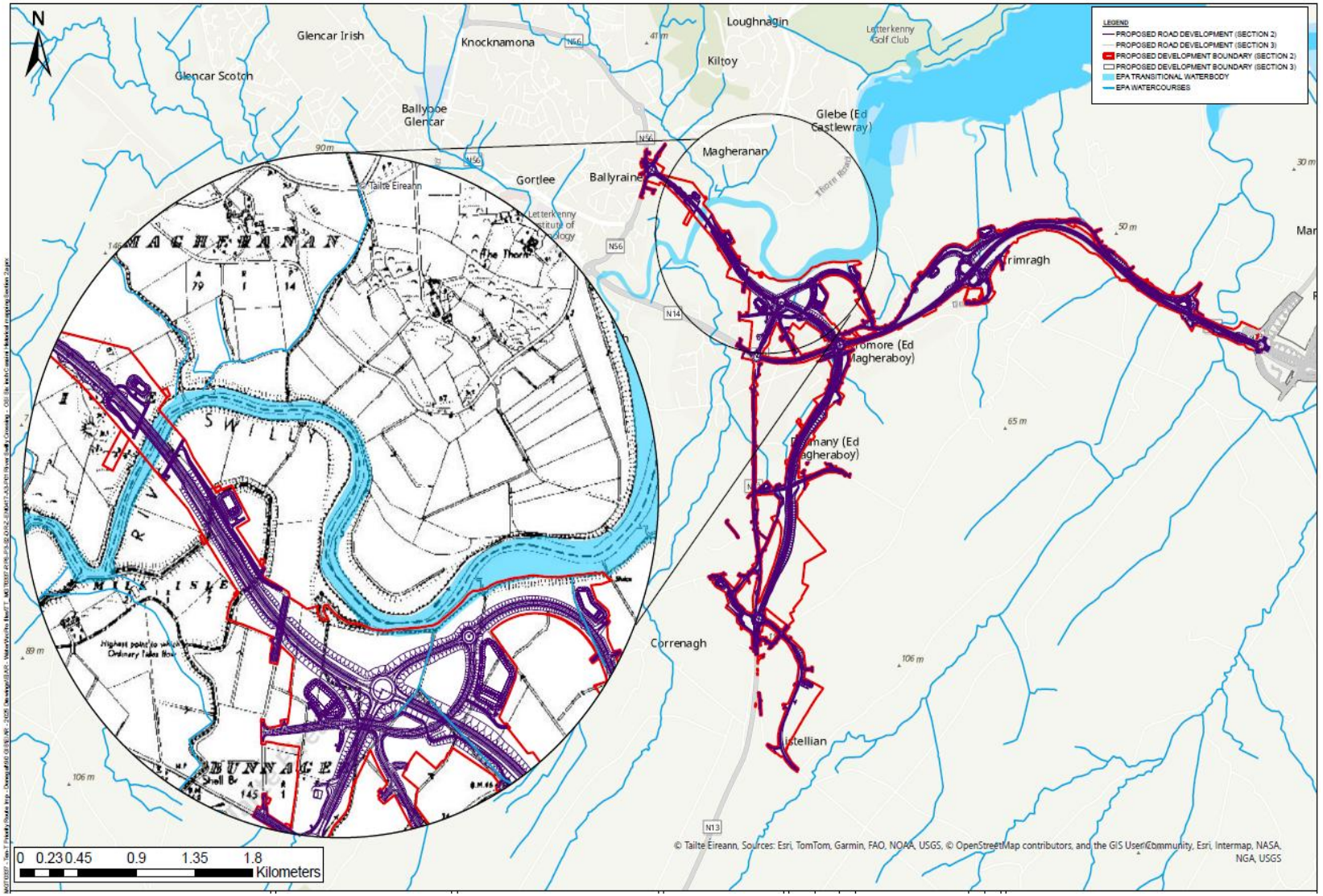

Figure 11-18: River Swilly Crossing – Section 2 OSI Six Inch Cassini Historical Mapping

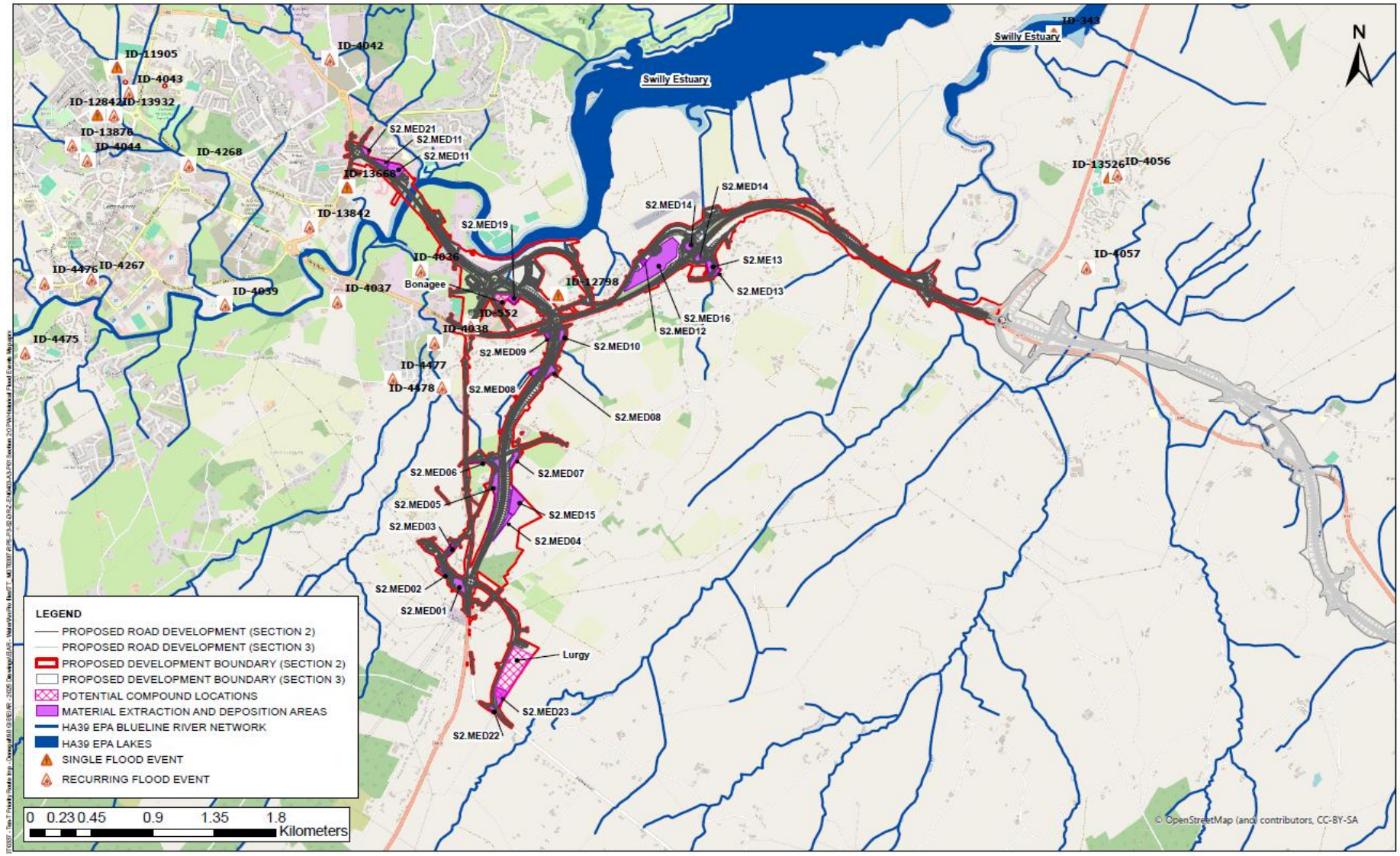

Figure 11-19: Section 2 Historical Flood Points

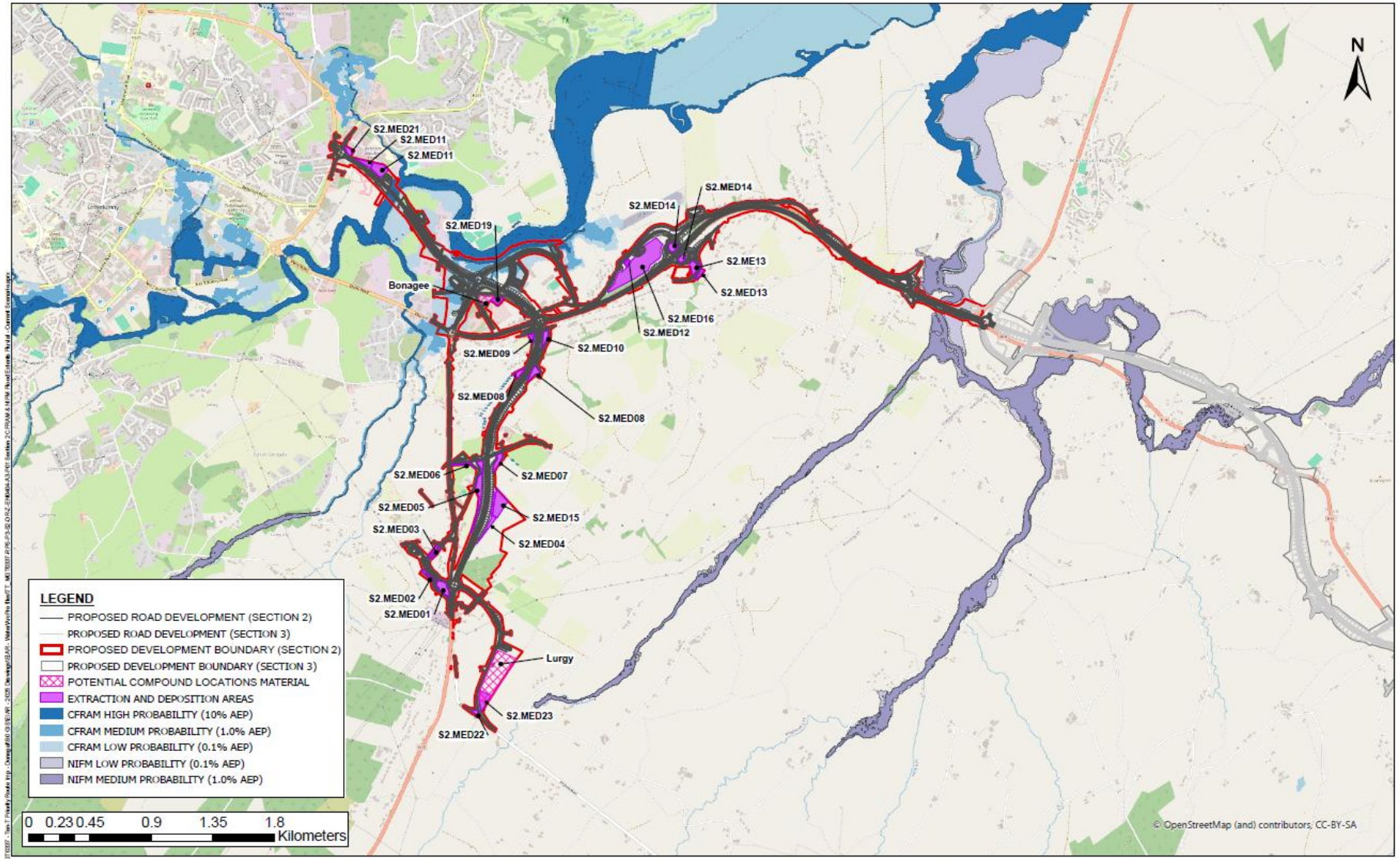

Figure 11-20: Section 2 CFRAM and NIFM Flood Extent Map (Fluvial – Current Scenario)

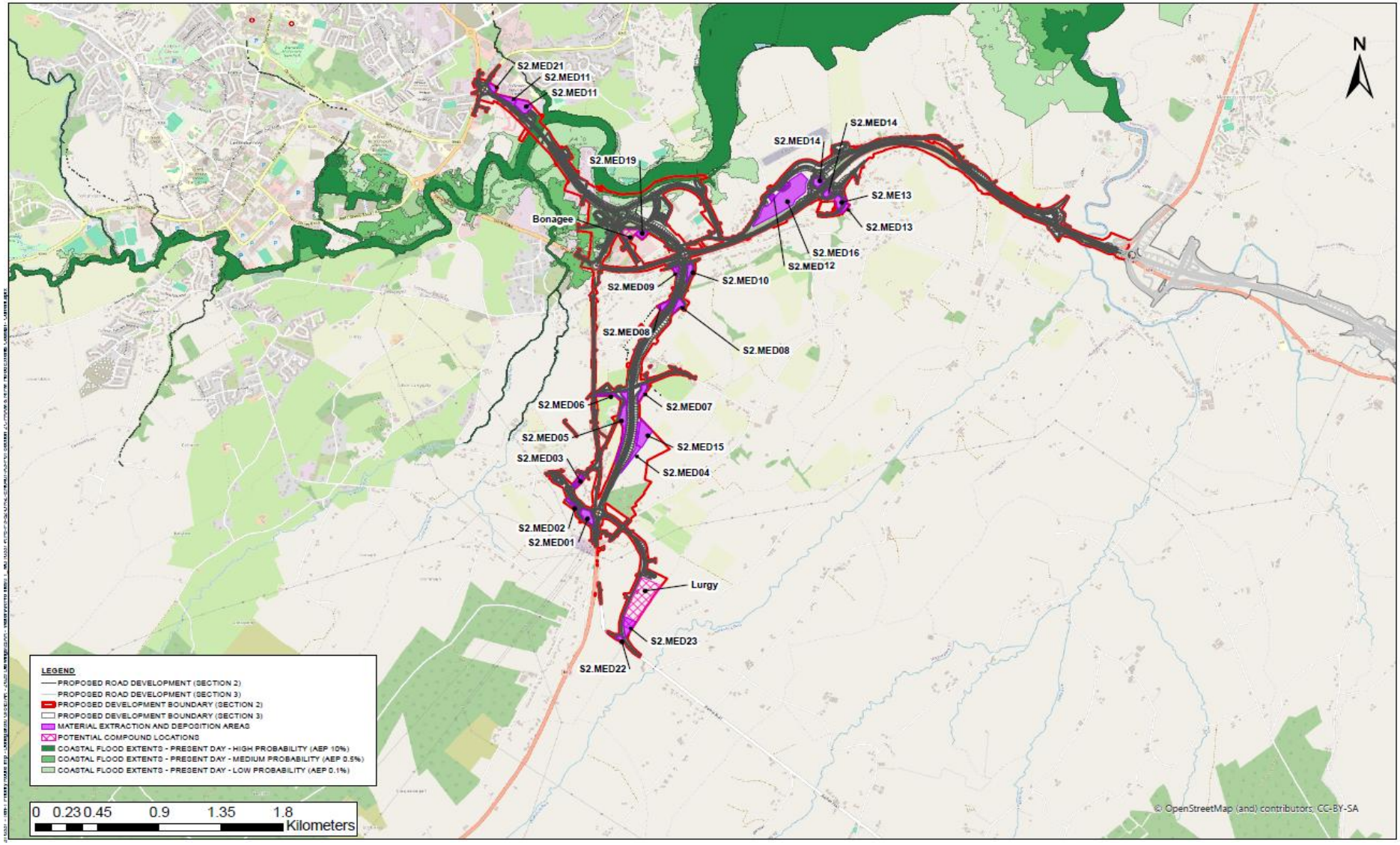

Figure 11-21: Section 2 CFRAM Flood Extent Map (Coastal – Current Scenario)

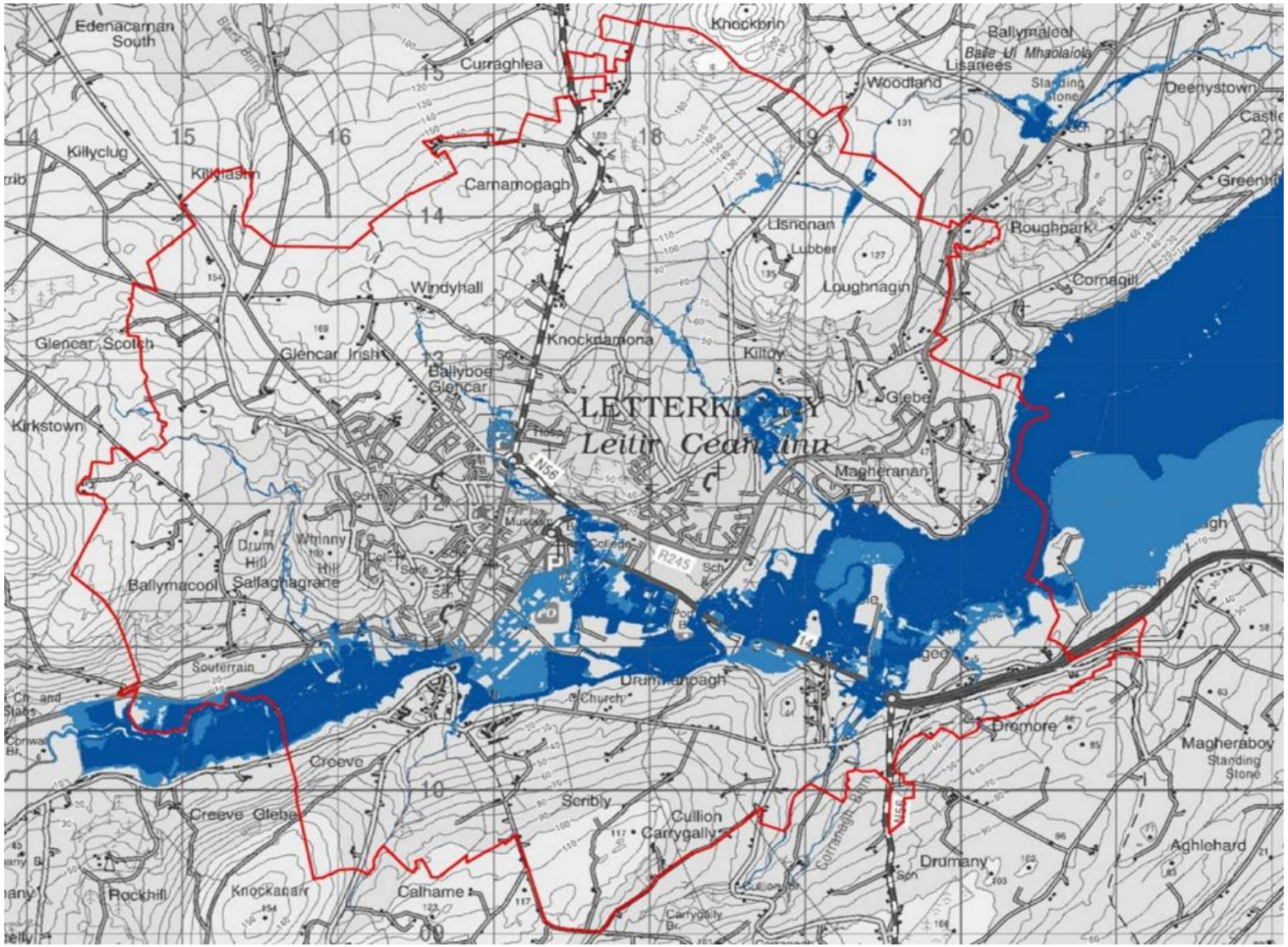

Figure 11-22: Section 2 Flood Zone Map (Letterkenny Local Area Plan SFRA, 2022)

11.4.3 Section 3 Existing Environment

The proposed route for Section 3 N14 Manorcunningham to Lifford/Strabane/A5 Link crosses the Deele River, the Swilly Burn, and the River Finn. In addition to these three significant rivers, in the vicinity of Manorcunningham, the route crosses the Leslie Hill Stream ("Isle Burn"), which flows into Lough Swilly.

11.4.3.1 Catchments

The scheme area lies within the Lough Swilly and the River Foyle Catchments, Hydrometric Areas 39 and 01 respectively. The division between both these catchments runs South West to North East and crosses the scheme area slightly to the North of the Regional Route the R236.

The major sub catchments within the Foyle catchment are those attached to the Deele, the Swilly Burn and the River Finn. Within the Foyle Catchment, the majority of the potentially affected waters of the scheme area are within the River Swilly Sub-Catchment.

The River Deele is a medium sized catchment (134 km^2) that forms part of the greater Foyle Catchment and originates in the hilly area to the west of the village of Convoy. The catchment is largely agricultural land with some peat and forest land coverage. The River Deele flows into the River Foyle approximately 2.8 km downstream of the River Finn/River Foyle confluence.

The River Finn is one of the major tributaries of the greater Foyle catchment (HA 01) and emanates from the Bluestack and Glendowan Mountains in the interior of Donegal. The River Finn flows into the River Mourne to form the River Foyle at Lifford/Strabane. The Finn catchment is a medium to large sized catchment (502 km^2) with a mixture of peat, pasture and forest coverage. In terms of plan area, the Proposed Development in Section 3 affects a small portion of the River Finn, by way of a multi span bridge crossing adjacent to the confluence of the River Finn and the Foyle just upstream of Lifford/Strabane.

The Swilly Burn has a small catchment that crosses the scheme from west to east. A tributary of this river approaches from the north, running parallel to the existing N14. Due to its current alignment, this tributary is physically impacted by the Proposed Development. The catchment for the Swilly Burn is largely agricultural.

The north of the scheme area drains to Lough Swilly Catchment (HA 39). Lough Swilly is a glacial fjord inlet into which the River Swilly flows at Letterkenny. The EPA delineated 'Pluck' watercourse is crossed three times along its length before joining Leslie Hill Stream (Isle Burn) and the Swilly Estuary at the northern end of the Proposed Development.

Table 11-24 presents the PCD for the Pluck Stream, River Finn, the Deele and the Swilly Burn.

Table 11-24: Section 3 - FSU Catchment Characteristics

PCDs	Pluck	River Finn	River Deele	Swilly Burn
Area (km^2):	59.88	502	134	59.4
Standard Average Annual Rainfall (SAAR) (mm):	1,110.72	1,037.5	1,290	1,052.3
FARL:	1	0.024	1.0	1.0
BFISOIL	0.552	0.561	0.402	0.587
Drainage Density (DRAIND) km per km^2:	1.607	1.493	1.493	1.297
Channel Flood Slope S1,085 (m/km):	6.808	3.245	5.53	3.41
ARTDRAIN^2	0.034	0	0	0.326
URBEXT	0.0076	0.0004	0.0085	0.011

An overview of the watercourses potentially be impacted by Section 3 are presented in Table 11-25 and illustrated in Figure 11-23. Figure 11-24 illustrates the extents of the River Finn, the River Deele, the Swilly Burn and the Leslie Hill Stream catchments areas and associated tributaries. EIAR Drawing 9B.03 in Volume D: Book of Drawings (Watercourse Survey Locations – Section 3) contains higher resolution maps of EPA watercourse and water body names, including aquatic biodiversity survey site locations on each that underpinned the identification of water receptor sensitivity. See Appendix C9B.01 for detailed aquatic survey site habitat and summary data and Appendix C9B.02 for representative images of aquatic ecology survey points on watercourses.

Table 11-25: Section 3 Overview of Potentially Impacted Watercourses

EPA Name	EU River Waterbody Code	Watercourse Segment Code	Relevant Aquatic Ecology Survey Site (s) Ref.	WFD Catchment	WFD Sub-Catchment	WFD River Sub-Basin
Leslie Hill (Stream)	IE_NW_39L050660	39_741	(Refer to W2-15)	Lough Swilly	LeslieHill[Stream]_SC_010	LESLIE HILL STREAM_020
Dooballagh (Burn)	IE_NW_39L050660	39_739	(Refer to W2-28)	Lough Swilly	LeslieHill[Stream]_SC_010	LESLIE HILL STREAM_020
Leslie Hill (Stream)	IE_NW_39L050660	39_740	(Refer to W2-15)	Lough Swilly	LeslieHill[Stream]_SC_010	LESLIE HILL STREAM_020
Churchland 39	IE_NW_39L050660	39_2497	W3-01	Lough Swilly	LeslieHill[Stream]_SC_010	LESLIE HILL STREAM_020
Leslie Hill (Stream)	IE_NW_39L050660	39_2527	(Refer to W2-15)	Lough Swilly	LeslieHill[Stream]_SC_010	LESLIE HILL STREAM_020
Leslie Hill (Stream)	IE_NW_39L050660	39_2958	(Refer to W2-15)	Lough Swilly	LeslieHill[Stream]_SC_010	LESLIE HILL STREAM_020
Pluck	IE_NW_39L050660	39_2522	(Refer to W3-02)	Lough Swilly	LeslieHill[Stream]_SC_010	LESLIE HILL STREAM_020
Pluck	IE_NW_39L050660	39_2506	W3-02	Lough Swilly	LeslieHill[Stream]_SC_010	LESLIE HILL STREAM_020
Pluck	IE_NW_39L050660	39_431	W3-03	Lough Swilly	LeslieHill[Stream]_SC_010	LESLIE HILL STREAM_020
Pluck	IE_NW_39L050660	39_429	(Refer to W3-04)	Lough Swilly	LeslieHill[Stream]_SC_010	LESLIE HILL STREAM_020
Pluck	IE_NW_39L050660	39_458	W3-04	Lough Swilly	LeslieHill[Stream]_SC_010	LESLIE HILL STREAM_020
Drumoghill	IE_NW_39L050660	39_2535	W3-05	Lough Swilly	LeslieHill[Stream]_SC_010	LESLIE HILL STREAM_020
Drumcarn	IE_NW_39L050660	39_209	(Refer to W3-05)	Lough Swilly	LeslieHill[Stream]_SC_010	LESLIE HILL STREAM_020
Drumoghill	IE_NW_39L050660	39_208	W3-06	Lough Swilly	LeslieHill[Stream]_SC_010	LESLIE HILL STREAM_020
Doorable	IE_NW_39L050660	39_925	W3-07	Lough Swilly	LeslieHill[Stream]_SC_010	LESLIE HILL STREAM_020
Pluck	IE_NW_39L050660	39_2110	W3-08	Lough Swilly	LeslieHill[Stream]_SC_010	LESLIE HILL STREAM_020
Pluck	IE_NW_39L050660	39_926	W3-08	Lough Swilly	LeslieHill[Stream]_SC_010	LESLIE HILL STREAM_020

EPA Name	EU River Waterbody Code	Watercourse Segment Code	Relevant Aquatic Ecology Survey Site (s) Ref.	WFD Catchment	WFD Sub-Catchment	WFD River Sub-Basin
Galdonagh_ Glebe	IE_NW_39L050660	39_2109	W3-09	Lough Swilly	LeslieHill[Stream]_SC_010	LESLIE HILL STREAM_020
Sheskinapoll	IE_NW_01S030500	01_384	W3-10	Foyle	JohnstonStream_SC_010	SWILLY BURN_030
Sheskinapoll	IE_NW_01S030500	01_385	W3-11	Foyle	JohnstonStream_SC_010	SWILLY BURN_030
Drumbeg	IE_NW_01S030500	01_143	(Refer to W3-12)	Foyle	JohnstonStream_SC_010	SWILLY BURN_030
Drumbeg	IE_NW_01S030500	01_1054	~	Foyle	JohnstonStream_SC_010	SWILLY BURN_030
Drumbeg	IE_NW_01S030500	01_292	W3-12	Foyle	JohnstonStream_SC_010	SWILLY BURN_030
Dromore_Big	IE_NW_01S030500	01_291	~	Foyle	JohnstonStream_SC_010	SWILLY BURN_030
Carnshannagh	IE_NW_01S030500	01_1114	~	Foyle	JohnstonStream_SC_010	SWILLY BURN_030
Drumbeg	IE_NW_01S030500	01_293	(Refer to W3-12 / W3-13)	Foyle	JohnstonStream_SC_010	SWILLY BURN_030
Drumbeg	IE_NW_01S030500	01_1332	W3-13	Foyle	JohnstonStream_SC_010	SWILLY BURN_030
Coolaghy	IE_NW_01S030500	01_321	~	Foyle	JohnstonStream_SC_010	SWILLY BURN_030
Tullyrap	IE_NW_01S030500	01_907	W3-15	Foyle	JohnstonStream_SC_010	SWILLY BURN_030
Swilly (Burn)	IE_NW_01S030500	01_1852	W3-14	Foyle	JohnstonStream_SC_010	SWILLY BURN_030
Swilly (Burn)	IE_NW_01S030500	01_1503	(Refer to W3-14)	Foyle	JohnstonStream_SC_010	SWILLY BURN_030
Swilly (Burn)	IE_NW_01S030500	01_320	(Refer to W3-14)	Foyle	JohnstonStream_SC_010	SWILLY BURN_030
Swilly (Burn)	IE_NW_01S030500	01_464	(Refer to W3-14)	Foyle	JohnstonStream_SC_010	SWILLY BURN_030
Tyleford	IE_NW_01D010650	01_1718	~	Foyle	Deele[Donegal]_SC_010	DEELE (DONEGAL)_050
Cavanacor	IE_NW_01D010650	01_1786	W3-18	Foyle	Deele[Donegal]_SC_010	DEELE (DONEGAL)_050
Deele (Donegal)	IE_NW_01D010650	01_1541	W3-17	Foyle	Deele[Donegal]_SC_010	DEELE (DONEGAL)_050
Deele (Donegal)	IE_NW_01D010650	01_1548	(Refer to W3-17)	Foyle	Deele[Donegal]_SC_010	DEELE (DONEGAL)_050
Deele (Donegal)	IE_NW_01D010650	01_1560	(Refer to W3-17)	Foyle	Deele[Donegal]_SC_010	DEELE (DONEGAL)_050
Murlough 01	IE_NW_01D010650	01_1558	W3-19	Foyle	Deele[Donegal]_SC_010	DEELE (DONEGAL)_050

EPA Name	EU River Waterbody Code	Watercourse Segment Code	Relevant Aquatic Ecology Survey Site (s) Ref.	WFD Catchment	WFD Sub-Catchment	WFD River Sub-Basin
Lifford	IE_NW_01D010650	01_1520	~	Foyle	Deele[Donegal]_SC_010	DEELE (DONEGAL)_050
Ballynabreen	IE_NW_01D010650	01_1519	W3-20	Foyle	Deele[Donegal]_SC_010	DEELE (DONEGAL)_050
Ballynabreen	IE_NW_01D010650	01_1521	(Refer to W3-20)	Foyle	Deele[Donegal]_SC_010	DEELE (DONEGAL)_050
Coneyburrow 01	UKGBNI1NW010104074	01_1915	~	Foyle	Finn[Donegal]_SC_030	Finn River
Finn (Donegal)	UKGBNI1NW010104074	01_7109	W3-21	Foyle	Finn[Donegal]_SC_030 Finn[Donegal]_SC_040	Finn River

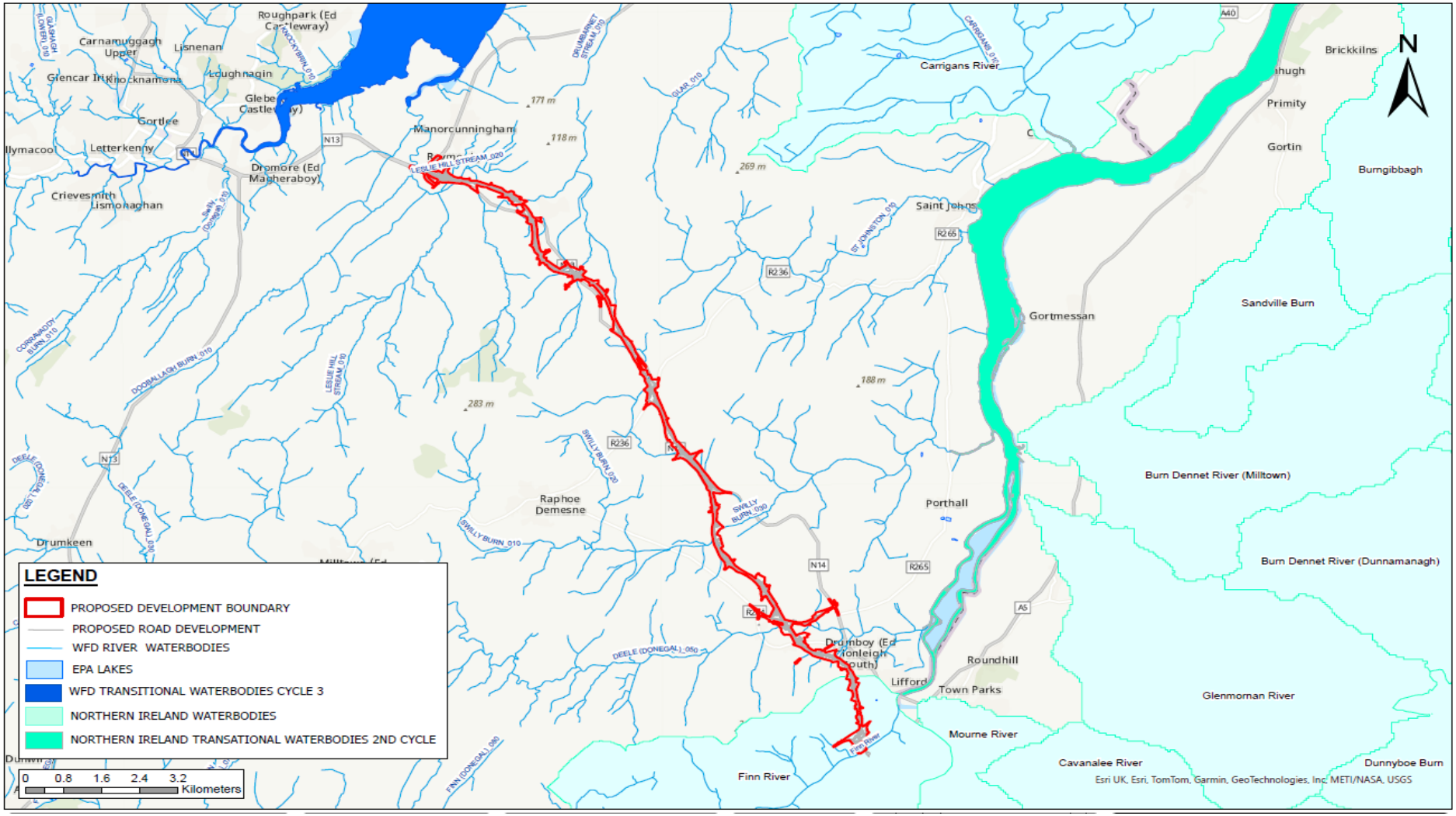

Figure 11-23: Section 3 Watercourse Interactions

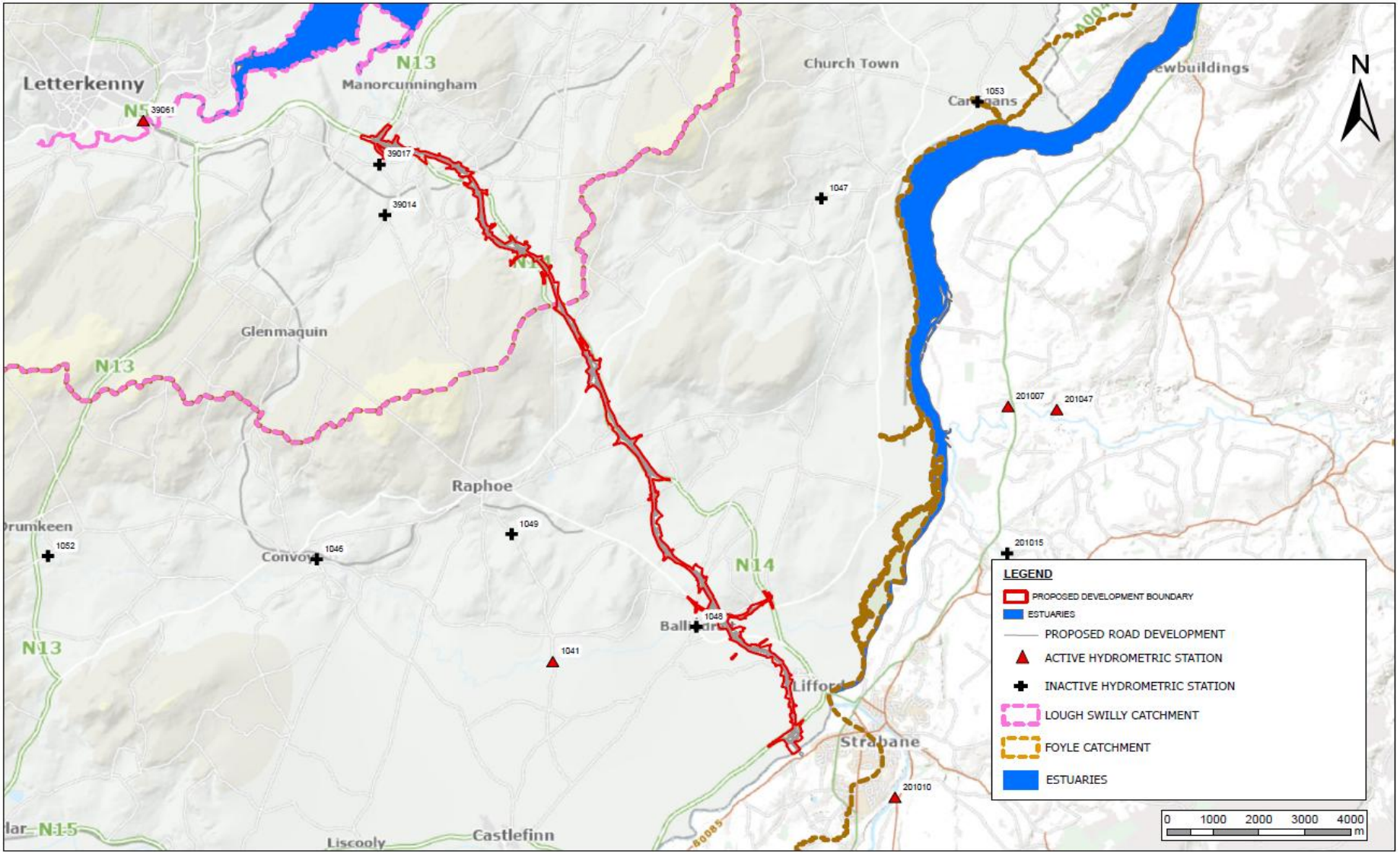

Figure 11-24: Section 3 Surface Water Features, Catchments (WFD catchments) and Hydrometric Gauge Locations

11.4.3.2 Ecological Importance of Hydrological Sites

See Chapter 9B: Biodiversity – Aquatic, Table 9B.21 for ecological importance of watercourses relevant to the Section 2 Proposed Development, including International and national designations. The data fed into the assigning of hydrological importance for the current assessment as per Table 11-1, above.

11.4.3.3 Hydrology

The scheme area lies within the Lough Swilly and the River Foyle Catchments, Hydrometric Areas 39 and 01 respectively. The division between both these catchments runs southwest to northeast and crosses the scheme area slightly to the North of the Regional Route the R236. The main surface water features potentially impacted by the Section 3 route include the River Deele and the Swilly Burn (both tributaries of the River Foyle), the River Finn, and the Leslie Hill Stream.

Table 11-26 provides a summary of catchment characteristics and estimated design flows for all watercourses that are to be crossed by the proposed Section 3 Road Route. Figure 11-25 illustrates the locations of these watercourses. These design flows have been estimated as part of this project using the FSU and FSR (Natural Environment Research Council, 1975) recommended methodologies.

Table 11-26: Section 3 Design Flows of Potentially Impacted Watercourses

EPA River Name	Watercourse Segment Code	Culvert Ref.	Mainline Chainage	Area (km^2)	SAAR (mm)	S1,085 (m/km)	BFI	Qmed	Estimated Flows (m^3/s) Q100 (incl. 20% CC)
Leslie Hill Stream_020	39_2497	S3-CUL.01 S3-CUL.02 S3-CUL.03	0+538 (AR 3.03, Mainline, LX 3014 Link South)	0.77	1,078	N/A	N/A	N/A	3.73
Leslie Hill Stream_020	39_2506	S3-CUL.04 S3-CUL.05	0+724 (Mainline, LX 3014 Link South)	22.65	1,068	15.65	0.57	8.71	51.10
Leslie Hill Stream_020	39_431	S3-CUL.06	1+100 (Mainline)	20.94	1,067	12.09	0.57	7.53	41.60
Leslie Hill Stream_020	39_458	S3-CUL.07	2+037 (Mainline)	13.85	1,065	19.56	0.56	5.84	23.62
Leslie Hill Stream_020	39_208	S3-CUL.08	2+600 (LX 3014 Drumoghill)	0.36	1,067	N/A	N/A	N/A	0.92
Leslie Hill Stream_020	39_209	S3-CUL.09	2+665 (Mainline)	0.40	1,067	N/A	N/A	N/A	1.00
Leslie Hill Stream_020	39_2535	S3-CUL.10 S3-CUL.11	2+350 (LX 3014 Drumoghill, AR 3.12)	1.056	1,069	19.61	0.56	0.52	2.15
Leslie Hill Stream_020	39_925	S3-CUL.12	4+100 (Mainline)	0.45	1,067	N/A	N/A	N/A	1.07
Leslie Hill Stream_020	39_925	S3-CUL.13	4+330 (LX 3014 Doorable)	0.45	1,067	N/A	N/A	N/A	1.07
Leslie Hill Stream_020	39_926	S3-CUL.14 S3-CUL.15	4+500 (LX 3014 Doorable,	2.778	1,072	44.35	0.59	1.58	6.50

EPA River Name	Watercourse Segment Code	Culvert Ref.	Mainline Chainage	Area (km^2)	SAAR (mm)	S1,085 (m/km)	BFI	Qmed	Estimated Flows (m^3/s) Q100 (incl. 20% CC)
		S3-CUL.16	Mainline, AR 3.22)						
Leslie Hill Stream_020	39_2109	S3-CUL.17	5+716 (Mainline)	0.346	1,067	N/A	N/A	N/A	0.66
Swilly Burn _030	01_384	S3-CUL.18 S3-CUL.19	6+550 (Mainline, LX3014 Sheshkinapoll)	1.26	1,068	2.96	0.57	0.46	2.29
Swilly Burn _030	01_385	S3-CUL.20	7+408 (Mainline)	2.26	1,054	8.28	0.57	0.96	4.34
Swill Burn_030	01_385	S3-CUL.21 S3-CUL.22 S3-CUL.23	8+185 (AR 3.32, Mainline, R236 LX 3014 Link South)	0.576	1,053	56	0.59	0.38	1.58
Swilly Burn _030	01_292	S3-CUL.24	9+250 (L2374 Whitecross)	7.96	1,054	26.24	0.58	3.67	15.50
Swilly Burn _030	01_1114	S3-CUL.25 S3-CUL.26	10+000 (LX 3014 Tullyrap, Mainline)	1.14	1,052	N/A	N/A	N/A	2.6
Swilly Burn _030	01_1332	S3-CUL.27	10+390 (Mainline)	9.85	1,052	24.63	0.59	4.61	19.38
Swilly Burn _030	01_1852	Swilly Burn River bridge	11+450 (Mainline)	24.22	1,065	17.32	0.60	7.73	24.51
Swilly Burn _030	01_907	S3-CUL.28	11+930 (Mainline)	0.72	1,047	1.54	0.60	0.26	2.09
Swilly Burn _030	01_907	S3-CUL.29	11+640 (Mainline)	1.64	1,047	N/A	N/A	N/A	4.66
Deele (Donegal)_050	01_1718	S3-CUL.30	13+950 (L2444 Ballindrait)	0.71	1,038	N/A	N/A	N/A	2.62
Deele (Donegal)_050	01_1541	Deele River bridge	14+400 (Mainline)	128.70	1,301	6.09	0.39	78.32	215.60
Deele (Donegal)_050	01_1786	S3-CUL.31	14+950 (Mainline)	0.71	1,038	N/A	N/A	N/A	2.11
Deele (Donegal)_050	01_1558	S3-CUL.32	15+150 (Mainline)	0.2	1,299	N/A	N/A	N/A	0.52
Deele (Donegal)_050	01_1519	S3-CUL.33	15+550 (Mainline)	0.23	1,296	N/A	N/A	N/A	0.60
Finn River	01_7109	N14/N15 to A5 Link Bridge	17+540	502	1,198				

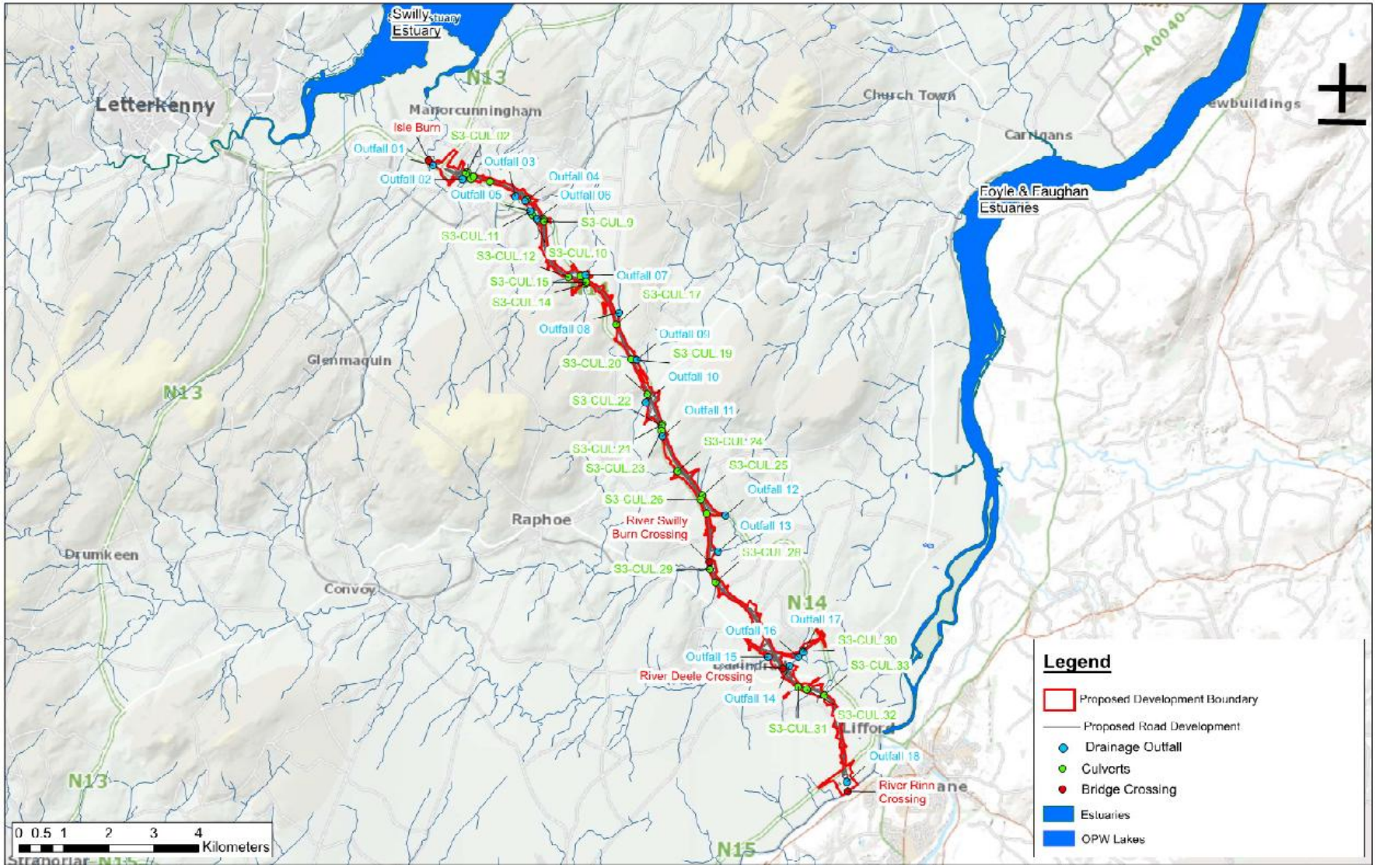

Figure 11-25: Section 3 Locations of Culverts, Bridges and Proposed Stormwater Outfalls

11.4.3.4 WFD Status and Q-values

River Q-values

WFD water body status and risk category for watercourses within the Proposed Development project are provided in the WFD Compliance Evaluation in Appendix C11.04. Water body status and risk category for the current reported period (2019 -2024) are illustrated in Figure 11-26 and Figure 11-27, respectively.

The most recent EPA Biotic Index (Q-Value) for Swilly Burn, Leslie Hill Stream, Deele river and River Finn in the vicinity of the Section 3 Proposed Development are tabulated in Table 11-27. Chapter 9B: Biodiversity – Aquatic, Appendix C9B.01 and C9B.03 contains additional Q-value data from aquatic ecology field studies at watercourse that were suitable for kick-sampling.

Table 11-27: EPA Q Value Data- Swilly Burn, Leslie Hill Stream, Deele river and River Finn

EPA Code	Station Name	2016	2019	2022/2023	2025
01S030300	Swilly Burn- Br 1.5 km SE of Raphoe, S Magheraha	2-3	3	3	3
39L050600	Leslie Hill Stream – Bridge at Leslie Hill	2-3	4	4	4
39L050400	Leslie Hill Stream-Bridge W. of Kincraigy	3	4	4	4
01D010600	Deele (Donegal) – Ballymonaster Br	4	4	3-4	4
01D010500	Deele (Donegal) – Bridge 1.5 km S.E. of Convoy	4	4	3	4
01F011100	River Finn – Castlefin Br.	~	~	3	3-4

Swilly Estuary

Adjoining Section 2, Section 3 also has hydrological connectivity to Swilly Estuary via tributaries of the Isle Burn (Leslie Hill Stream). Swilly Estuary is a Transitional Waterbody (EPA code: IE_NW_220_0100) monitored by the EPA, currently assigned ‘poor’ status (EPA data 2019-2024) based on phytoplankton (P), general physicochemical conditions(M), nutrient and phosphorus conditions (H) (EPA Envision Maps, Accessed November 2025). It is categorised as “At-Risk” of not obtaining good status by 2027.

Foyle and Faughan Estuaries

The southern half of Section 3 drains via tributaries and main channels of the Swilly Burn, Deele and Finn rivers, which flow into the River Foyle, named ‘Foyle and Faughan Estuaries’ transitional water body (UKGBNI5NW250010) and on to Lough Foyle. The River Foyle is covered by the River Finn SAC on the Republic of Ireland side and River Foyle and Tributaries SAC on the Northern Ireland side of the river. The ‘Foyle and Faughan Estuaries’ transitional waterbody is a transboundary, heavily modified water body (HMWB). Responsibility for ecological classification of this water body rests with the Northern Ireland Environment Agency (NIEA). Formal correspondence with the NIEA was undertaken in January 2026 in relation to the Proposed Development. NIEA then issued a formal status assessment for 2021 and 2024 (Table 11-28). As an HMWB, current surface water status of the Foyle and Faughan transitional waterbody is assigned 'Moderate Ecological Potential'. The EPA (ROI) last assigned Moderate Ecological Potential status to this water body in the 2013-2018 WFD reporting period based on the NIEA classification, noting that elevated phosphate concentrations were identified as a significant issue (EPA, 2018). Whilst the water body fails to achieve good ecological potential, it is noted the biological quality elements meet high (phytoplankton) and good (fish) ecological potential. This transitional water body is not directly impacted by the Proposed Development.

Table 11-28: Classification of Foyle Harbour & Faughan Transitional water under The Water Environment (Water Framework Directive) Regulations (Northern Ireland) 2017

Quality Element	Year	
Biological Quality Element	**2021**	**2024**
Phytoplankton	High	High
Macroalgae		
Angiosperms		
Zoobenthos		
Fish	Good	Good
Supporting Quality Element	**2021**	**2024**
Dissolved Oxygen	High	High
Dissolved Inorganic Nitrogen	Moderate	Moderate
Specific Pollutants	Moderate	Moderate
Hydro - morphology	HMWB	HMWB
High impact invasive species	Good	Good
Ecological Status	**Moderate Ecological Potential**	**Moderate Ecological Potential**
Chemical Status	**< Good**	**< Good**
Surface Water Status	**Moderate Ecological Potential**	**Moderate Ecological Potential**

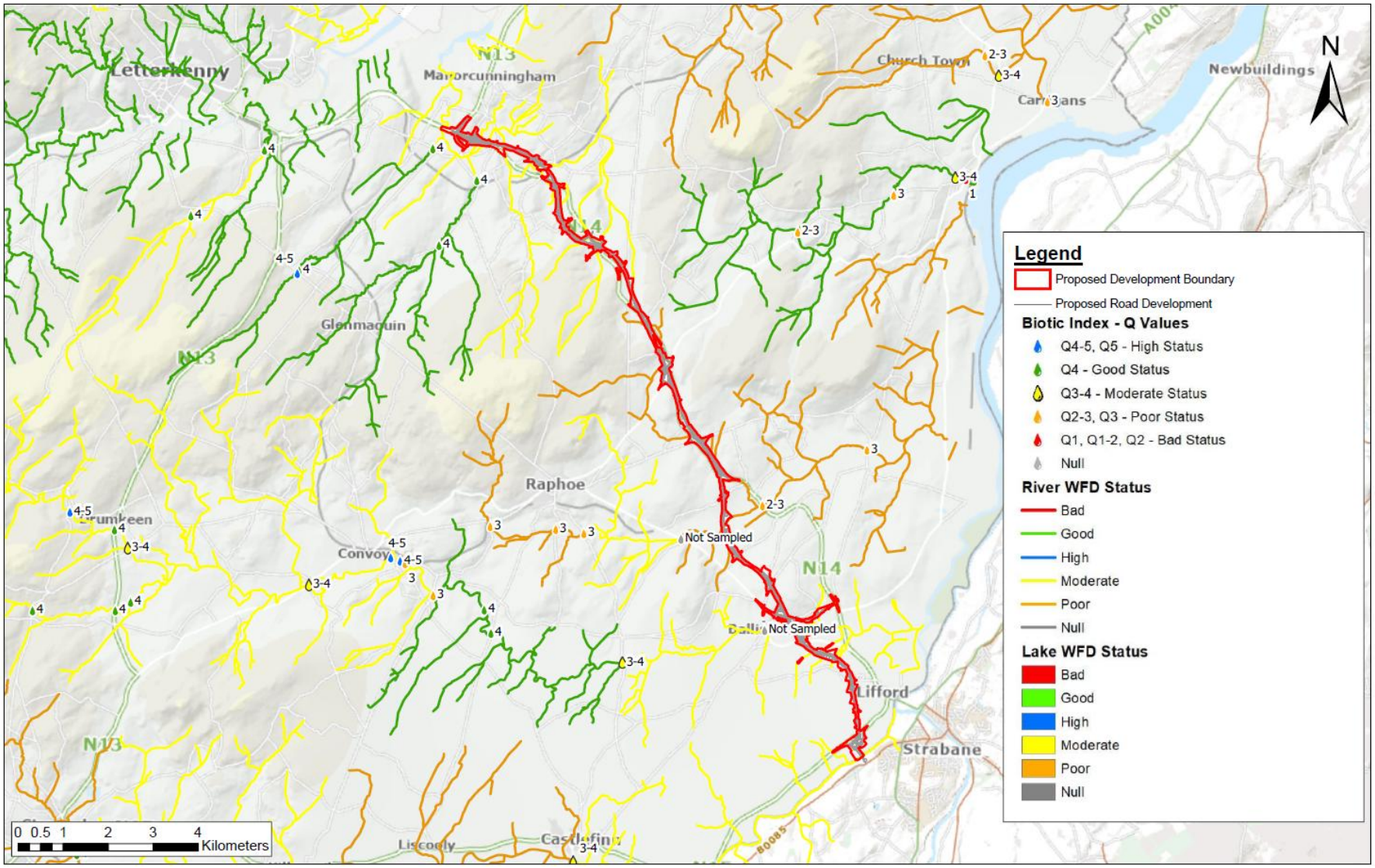

Figure 11-26: Section 3 EPA WFD Water Body Status Map (2019-2024)

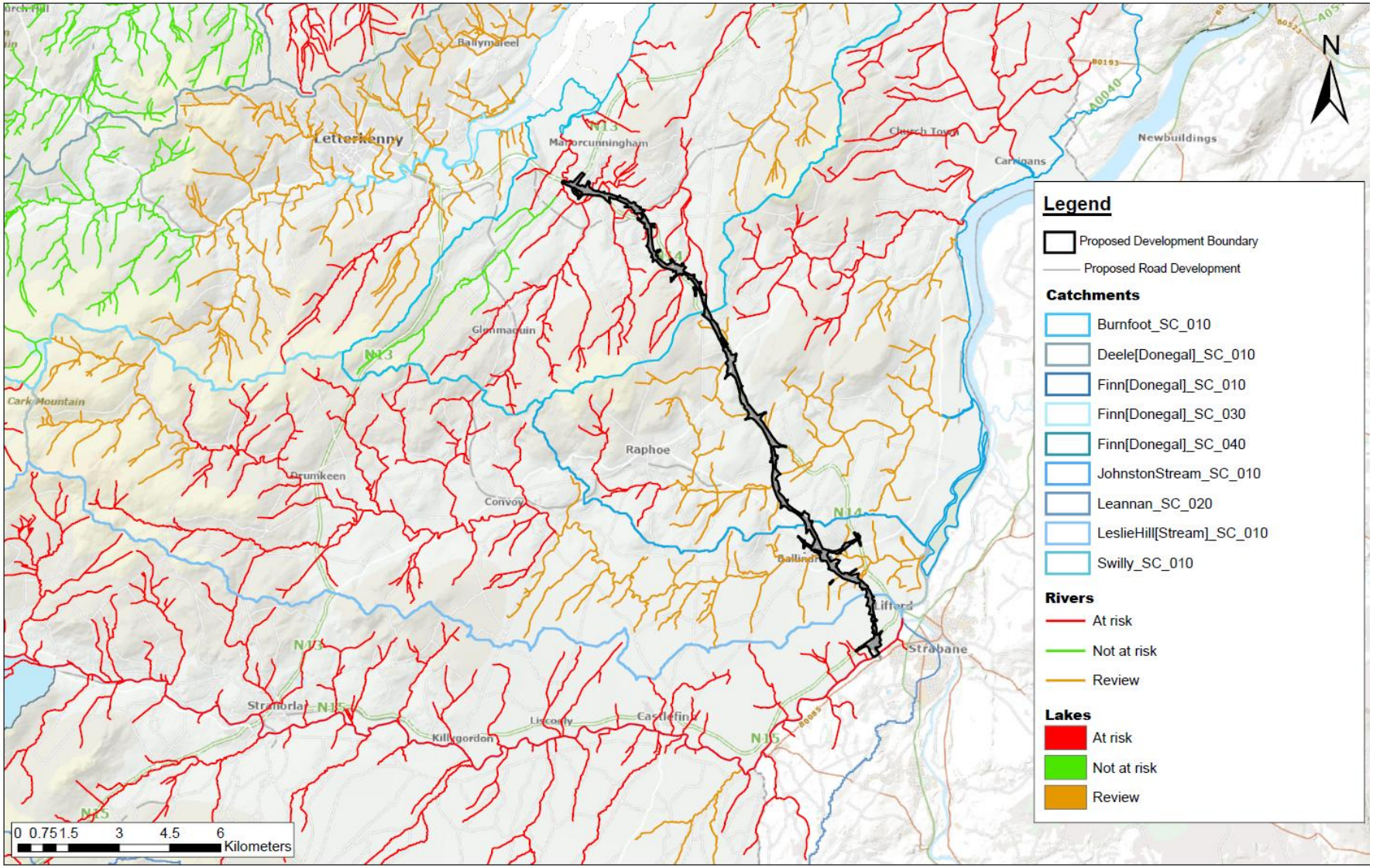

Figure 11-27: Section 3 EPA WFD Waterbody Risk Map (2019-2024)

11.4.3.5 Groundwater

The hydrogeological baseline environment and impact assessment are addressed in Chapter 10: Land, Soil & Hydrogeology.

11.4.3.6 Potable Water

There are no surface water abstraction points in the vicinity of the proposed scheme. Aspects relating to potable water are covered in Chapter 10: Land, Soil and Hydrogeology.

11.4.3.7 Wastewater Discharges

Figure 11-28 illustrates the locations of discharge points from industrial and municipal sewage effluent discharges. There are three water discharge points in the region, located at Manorcunningham, Raphoe and Lifford.

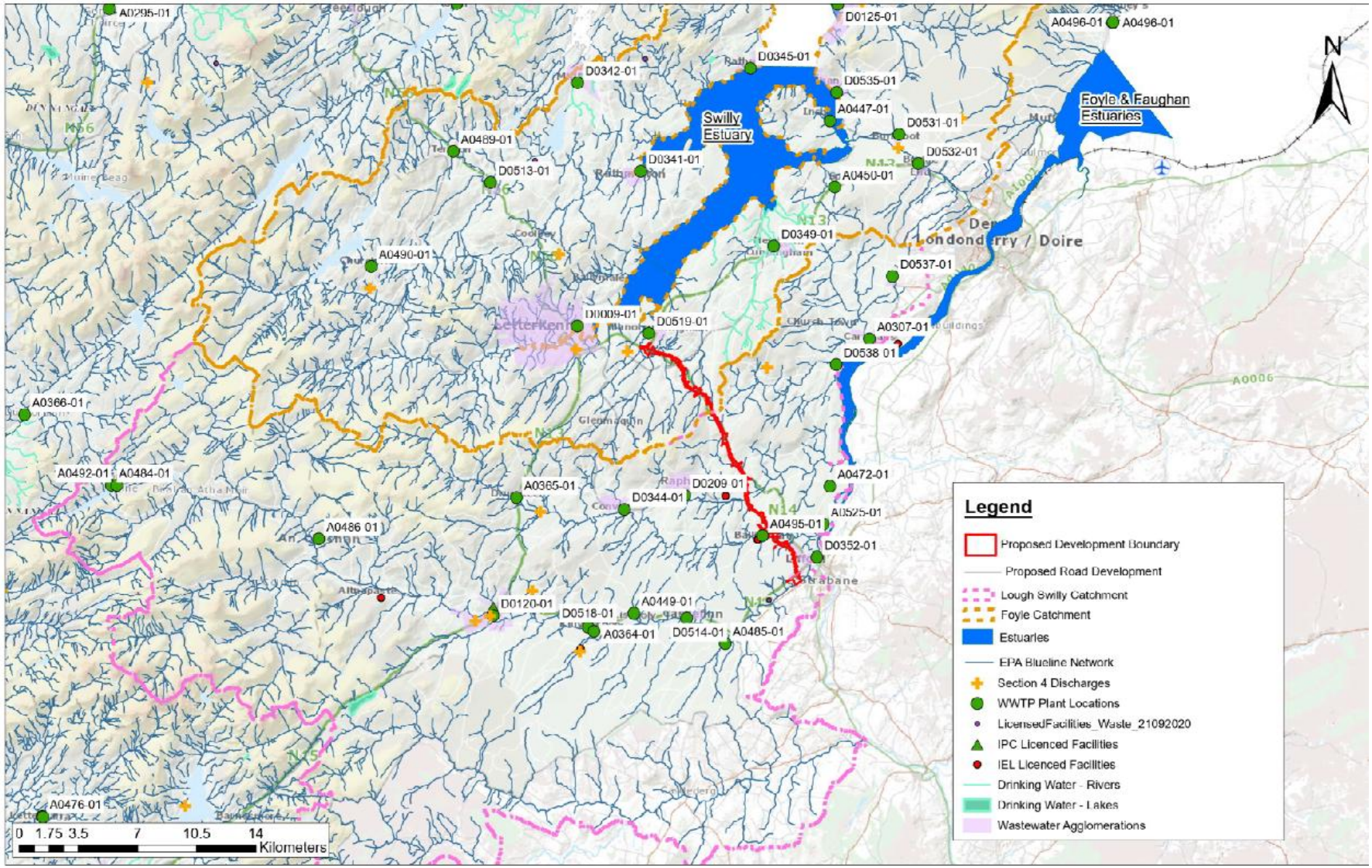

Figure 11-28: Section 3 Potable Water and WWTP

11.4.3.8 Flooding

Flood risks to the Proposed Development have been investigated by reviewing all available historical flood information and any flood maps prepared for the scheme area under any previous flood studies (source: www.floodinfo.ie). The flood risk posed by the Section 3 Proposed Development is assessed in Section 11.6.3.

OSI Historical Mapping

Swilly Burn River: The historical 6-inch mapping does not indicate that the lands in the vicinity of the Swilly Burn are liable to floods. This would be congruent with what was found during the hydraulic analysis of the watercourse, which was carried out as part of the section 50 Application (Section 50 of the Arterial Drainage Act 1945, requires consent from the Office of Public Works (OPW) for the construction or alteration of bridges and culverts to ensure flood risk management and compliance with hydraulic standards). However, the section 50 Application only assessed up to the 1 in 100-year event. Currently there are bunds each side of the watercourse, which could function as flood defences. They bunds do not appear to be indicated on the historical mapping.

Deele River: The historical 6-inch mapping indicates that the lands in the vicinity of the Deele are liable to floods. This would be congruent with what was found during the hydraulic analysis of the watercourse, which was carried out as part of the section 50 Application.

Finn River: The historical 6-inch mapping indicates that the lands in the vicinity of the Deele are liable to floods. This would be congruent with what was found during the hydraulic analysis of the watercourse, which was carried out as part of the section 50 Application.

Drumbeg: The historical 6-inch mapping indicates numerous references to a mill along the Drumbeg Stream (Approximate Mainline Chainage 9+200). The references relate to, sawmill, flat mill and a mill pond, indicating the village of Drumbeg was previous host to a number of businesses which used the stream. The location of these historical mills is within the land take itself, and the existing stream is to be diverted and culverted in the vicinity. As these mills are no longer in operation, and none of these features are currently influencing the watercourse in the vicinity they are not considered relevant to the Proposed Development.

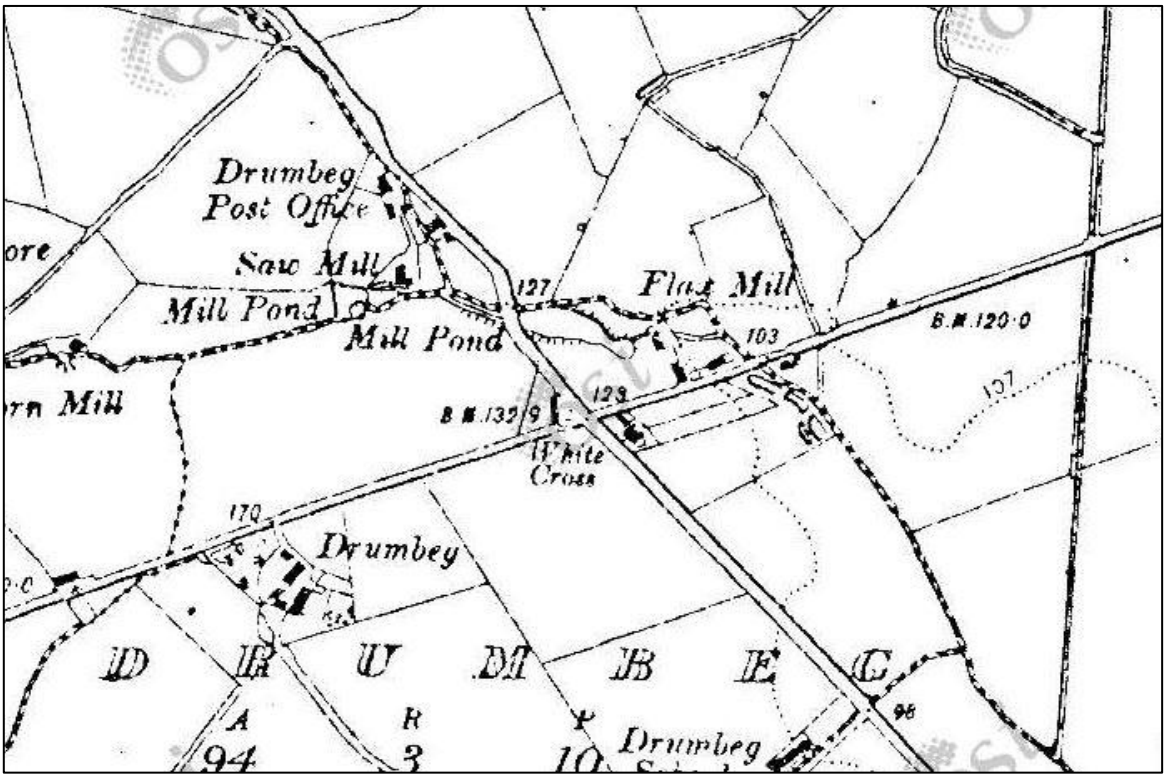

Figure 11-29: References to Mills in Drumbeg Village

OPW Flood Hazard Mapping

The Flood Hazard Mapping Website (www.floodmaps.ie) is a record of historic flood events maintained by the OPW. The data available was reviewed to obtain information on recorded flood events within the scheme area. Table 11-29 below shows the location of the recording flooding events.

Table 11-29: Flood Recordings

Flood I.D	Location	Date(s) of report(s)	Recorded date of occurrence	Frequency	Description
4053	Curraghalane	11 January 2006	Annual	Annual	River Finn overflows its banks every year after heavy rain from Lifford to Stranorlar.
4052	Lifford	11 January 2006, 26 November 2006	Not recorded	Varies (Refer to Description column opposite)	River Foyle overflows its banks occasionally (approx once every 30 years) through a combination of heavy rain and high tides. Properties are liable to flood. Low area behind McCauley's café – frequent prior to installation of storm pump
4051	Ballindrait	11January 2006, 15 March 1993	Not recorded	Varies (Refer to Description column opposite)	River Deele overflows its banks every year after heavy rain. The road is liable to flood once every five years approximately.
11904	Ballindrait	27 November 2013	26 July 2013	Single recorded event.	Flooding of River Deele in Ballindrait.
346	Rossgier, Ballindrait	15 December 2000	28 October 2000	Not established. Report references two occasions	Homeowner reported flooding of domestic house and garden by the Deele.
4050	Mullnaveagh	11 January 2006	Annual	Annual	Mullnaveagh - River Swilly Burn overflows its banks every year after heavy rain.
4054	Ballindrait.	11 January 2006, 15 March 1993	Annual	Annual	Swilly Bridge - River Swilly Burn overflows its banks every year after heavy rain.
4045	Kincraigy	11 January 2006	Annual	Annual	River Corkey overflows its banks every year after heavy rain.
4056	Manorcunningham	11 January 2006	No specific date recorded.	Every five years	Runoff from high ground causes flooding every five years approximately after very heavy rain. The road is liable to flood and properties are affected.
4057	Manorcunningham	11January 2006	No specific date recorded.	Every ten Years	Runoff from high ground causes flooding every ten years approximately after very heavy rain. The road is liable to flood and properties are affected.

The Deele was found to have a wide flood plain which the Proposed Development footprint will impact upon. To mitigate the impact to the upstream waters and to allow continuity of the flood plain, flood alleviation culverts are proposed which will work in tandem with the proposed bridge openings. The bridge structure and the flood culverts have been designed to ensure water levels within Ballindrait are not affected.

OPW CFRAM Study and NIFM

The extents of the CFRAM mapping and the NIFM (National Indicative Fluvial Mapping) in the vicinity of the proposed route have been indicated in Table 11-30, which itemises the locations where the proposed route impacts on the flood events modelled as part of the CFRAM and NIFM studies. Where considered necessary, more detailed flood studies were carried out as part of the Flood Risk Assessment for Section 3 which has been provided in Appendix C11.03.

Strategic Flood Risk Assessment (SFRA), Donegal County Development Plan 2024 - 2030:

Under the Donegal County Development Plan 2024-2030 a Strategic Flood Risk Assessment (Donegal County Council., 2024a) was prepared in accordance with the requirements of “The Planning System and Flood Risk Assessment Guidelines for Planning Authorities (2009) Circular PL02/2014 (August 2014)”. In this SFRA, flood zone maps were prepared for all planning areas. These flood zones were derived from the North-Western Neagh Bann CFRAM and ICWW studies predicted flood maps which are similar to the flood zones prepared in the 2021 SFRA (see Figure 11-31 and Figure 11-32). It can be seen from this map that much of Section 3 is located in Flood Zone C, however the low-lying floodplains of the River Finn, Deele and Swilly Burn and Leslie Hill Stream are zoned as Flood Zone A & B. The proposed road embankments will encroach this flood prone areas at the relevant bridge crossings.

Table 11-30: Section 3 Road Route Predictive Flood Risks (CFRAM & NIFM Studies)

EPA Name	Watercourse Segment Code	Crossing/ Encroachment	Flood Risk Details
Leslie Hill Stream	39_741	Encroachment	The proposed attenuation pond to the North of the proposed N13/N14 Pluck Roundabout encroaches on the 0.1% AEP flood extents (CFRAM). The 0.1 AEP flood extents also encroach on the existing N13 to the northwest of the proposed roundabout.
Churchland 39 and the Pluck (Both of these separate watercourses are within the flood extents of the CFRAM mapping in the region as described in the column 'Flood Risk Details).	39_2506 (Pluck) 39_2497 (Churchland 39)	Crossing & Encroachment	Between Mainline Chainage 0+310 and 0+900, the existing N14, the proposed route of the N14, the proposed realignment of the L1294 (Manorcunningham Local Road), the attenuation pond to the North of the mainline at Chainage 0+500, a proposed access track to the north of the alignment (between Mainline Chainages 0+350 and 0+920) together with the proposed cycleways to the North and South of the proposed N14 impact on the 1.0% AEP flood extents (CFRAM)
Pluck	39_431	Crossing & Encroachment	The existing N14 and the proposed N14 impose on the 1.0% AEP flood event between Mainline Chainage 1+050 and 1+200 (CFRAM)
Drumbeg, Carnshannagh and Dromore Big (All of these separate watercourses are within the flood extents of the CFRAM mapping in the region as described in the column 'Flood Risk Details).	01_1114 Carnshannagh 01_291(Dromore Big) 01_292(Dromore Big) 01_293(Dromore Big) 01_1332(Drumbeg)	Crossing & Encroachment	Between Mainline Chainage 9+200 to 10+400, the proposed N14 Mainline, the existing N14, the proposed sideroad the LX 3014 (Tullyrap), the proposed sideroad the LX3024 (Whitecross), the proposed sideroad the L2374(Whitecross) and the proposed attenuation pond at Mainline Chainage 9+400 encroach on the 1.0% AEP flood extents (CFRAM). Whilst these encroachments are substantial in places, the existing watercourse which was the cause of this flooding is to be diverted between Mainline Chainages 9+200 and 10+200. The new watercourse diversion has more capacity than the existing stream, and a flooding assessment has determined the diverted watercourse will prevent out of bank flooding during the 1.0% AEP flood event.
Swilly Burn and Tullyrap (All of these separate watercourses are within the flood extents of the CFRAM mapping, as described in the column 'Flood Risk Details).	01_1333(Swilly Burn) 01_907(Tullyrap)	Crossing & Encroachment	Between approximate mainline Chainages 11+100 12+100, the proposed N14, the proposed sideroad realignment the L2424(Mullinavegh), the attenuation pond at 11+600, and some proposed access tracks, impact on the 1.0% AEP flood event (CFRAM).
Deele	01_1548	Crossing & Encroachment	• The proposed N14 mainline has a significant encroachment on the 1.0% AEP and the 0.1% AEP flooding extents (CFRAM). • The proposed 2.0-kilometre long Ballindrait Sideroad Realignment has a slight impact on the 1.0% AEP and the 0.1% AEP flooding extents (CFRAM).

EPA Name	Watercourse Segment Code	Crossing/ Encroachment	Flood Risk Details
			• The attenuation pond at Chainage 1+300 (On the Ballindrait Sideroad Realignment), has a slight impact on the 0.1% AEP flooding extents (CFRAM). • The attenuation pond at Mainline Chainage 14+500 has a moderate impact on the on the 1.0% AEP and 0.1% AEP flooding extents (CFRAM)
Finn	01F01	Crossing and encroachment.	• The proposed Lifford Junction has a slight impact on the 1.0% AEP flooding extents (CFRAM). • The N15 Lifford Tie in East has a slight impact on the 0.1% AEP flooding extents (CFRAM). • The A5 Link Bridge crossing the Finn has a slight impact on the 1.0% AEP flooding extents.

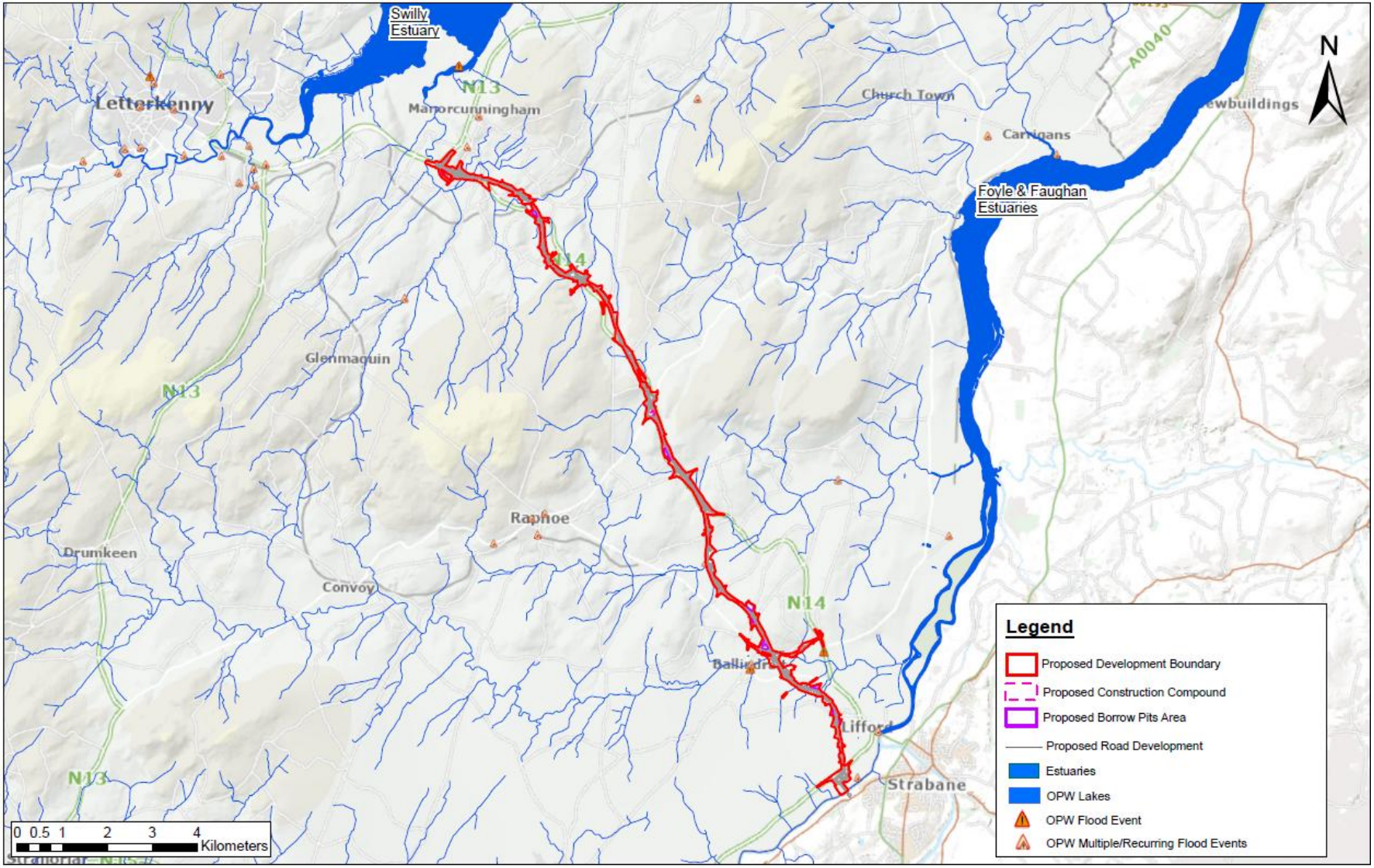

Figure 11-30: Section 3 - Historical Flood Points

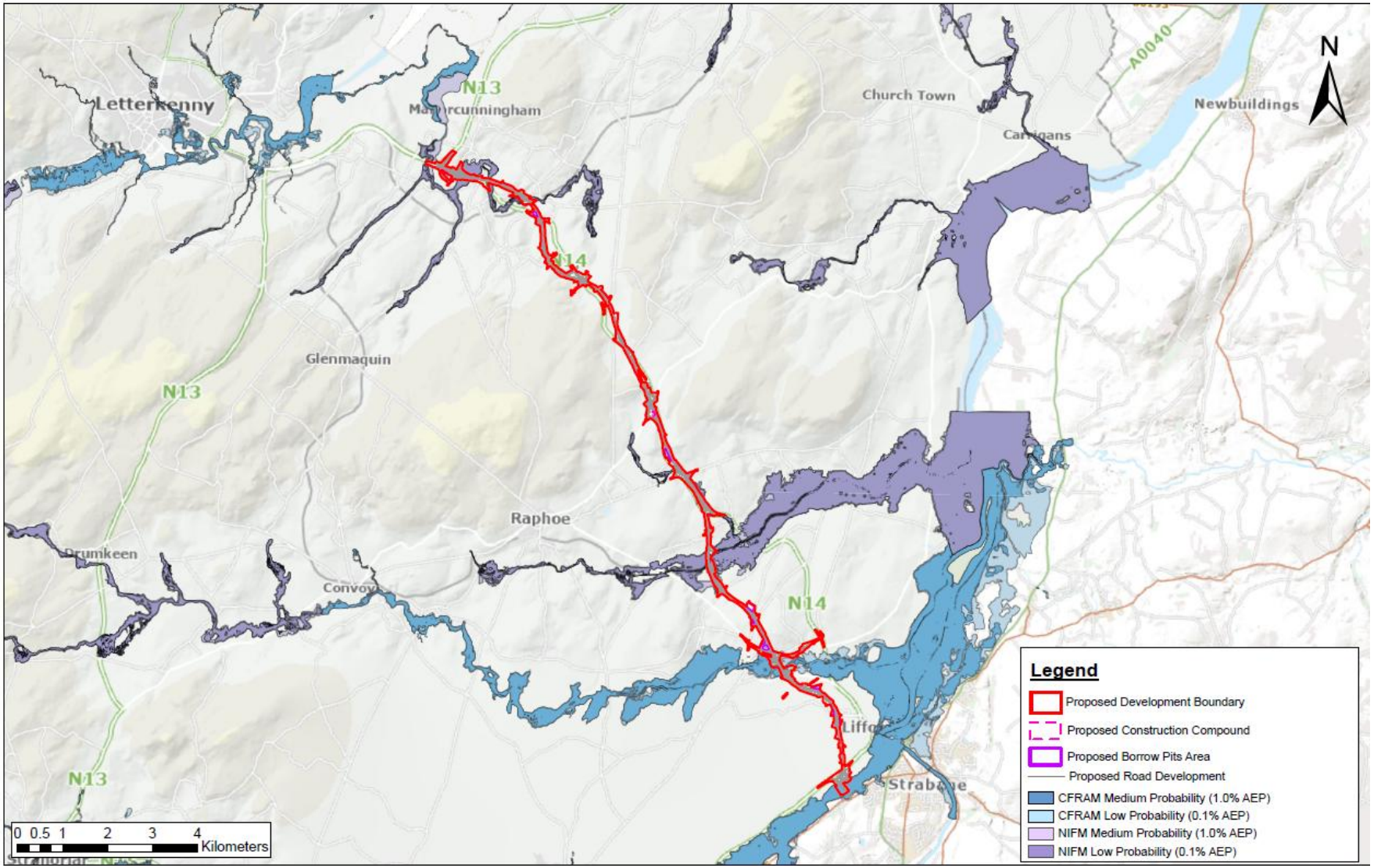

Figure 11-31 CFRAM Flood Extent Map (Fluvial-Current Scenario)

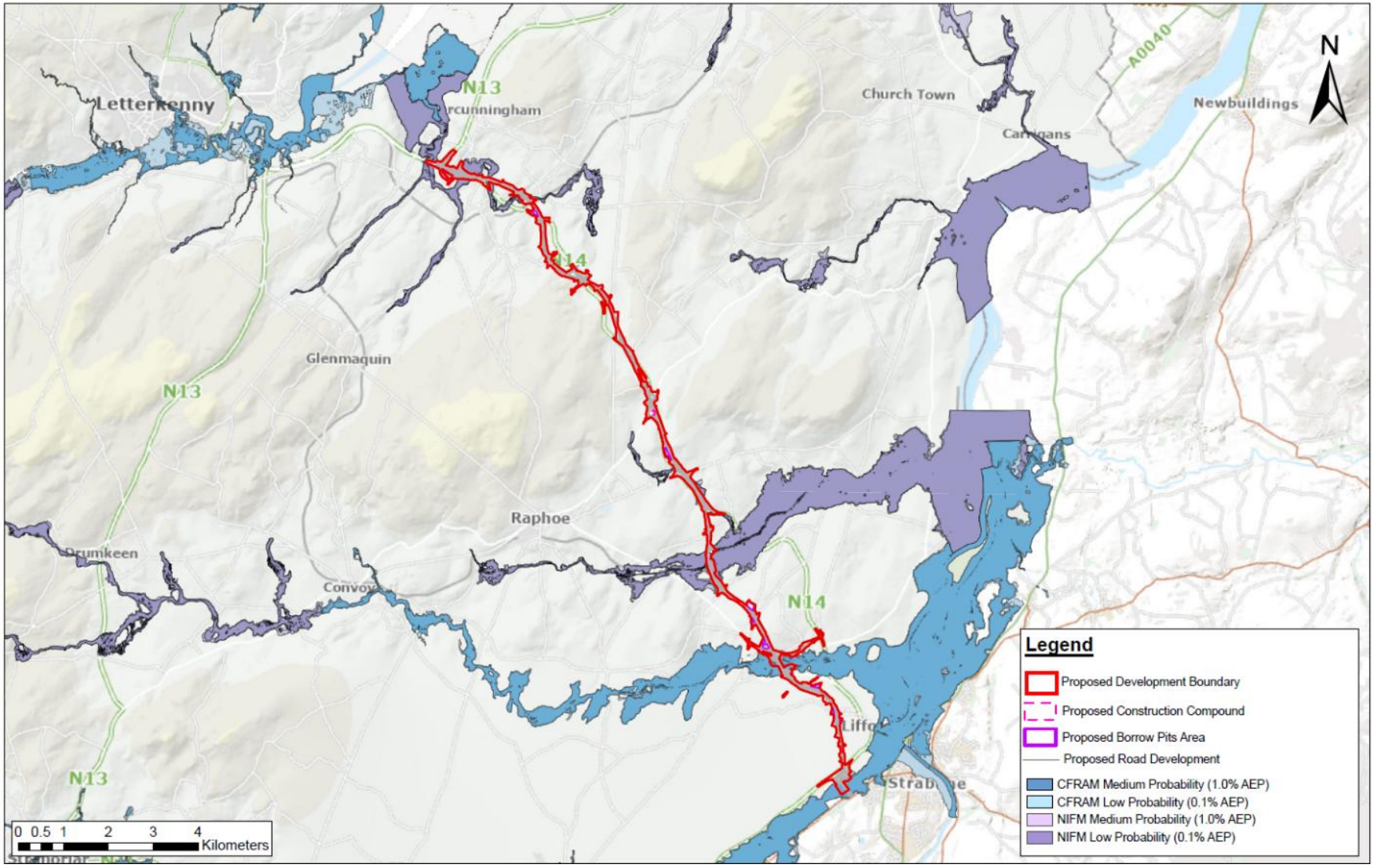

Figure 11-32 Flood Zone Map (SFRA, Current Scenario) Proposed Surface Water Drainage

11.5 Proposed Surface Water Drainage

The Proposed Development requires the construction of new surface water drainage systems across all sections, including new outfalls to existing watercourses or surface water drainage networks. Extensions to existing culverts and the construction of infiltration ditches and attenuation ponds are also included as part of the Proposed Development.

- Section 1: total of 39 No. culverts for water crossings are proposed and three river bridges.
- Section 2: total of 37 stream culvert sites proposed and two river bridges.
- Section 3: total of 33 stream culvert sites proposed and three river bridges.

A total of 50 major outfalls across the mainline and link road drainage networks for the three sections have been identified all of which require attenuation measures prior to being discharged to either an existing watercourse or to ground.

A drainage system for the Proposed Development has been designed such that surface water and sub-grade drainage will be provided for the mainline carriageway, link roads and all new sections of local and regional roads.

11.5.1 Section 1 Proposed Surface Water Drainage

In Section 1, there are 39 stream culvert sites and three river bridges. The most significant bridge is a 360 m long, seven span crossing of the River Finn and its floodplain in the townland of Drumboe Lower. The River Finn has an upstream catchment area of 309.96 km^2 at this proposed crossing. All crossings have been designed considering the hydraulic requirements for road crossings.

11.5.1.1 Culverts

There are 39 culverts proposed along the mainline/ connector/ link road carriageways. Table 11-31 lists these culverts along with their required sizes. Figure 11-25 illustrates the location of these culverts. A full list of culvert locations is provided in Chapter 4: Project Description. Culverts or pipes with a clear span greater than 2.0 m are classified as structures in accordance with the DN-STR-03001 (BD 2).

Most culverts were sized based on the calculations set out in the updated CIRIA Culvert, Screen and Outfall Manual (2019), (CIRIA Report No. C786). Culverts S1-CUL.14 and S1-CUL.28 were sized using HEC-RAS modelling software. These design flows for all culverts were estimated using the methodology recommended in the Flood Studies Updates and Flood Studies Reports as discussed in Section 11.2.5 earlier.

Table 11-31: Section 1 Culvert Design Parameters

Culvert Ref	Catchment Area (km^2)	SAAR (mm)	Design Flow (Q100 + 20% CCA)	Culvert Diameter (m) / Width (m) x Height (m)	Length (m)	Depth of Embedment (m)	Culvert Gradient (1:x)
S1-CUL.01	0.98	1,704.7	5.89	3.2 x 2	51.8	0.5	162.8
S1-CUL.02	0.02	1,704.7	0.254	1.2Ø	34.1	0.3	494.4
S1-CUL.03	0.05	1,704.7	0.462	1.2Ø	30.5	0.3	26.7
S1-CUL.04	0.14	1,704.7	0.66	1.2Ø	9.0	0.3	204.5
S1-CUL.05	0.14	1,704.7	0.66	1.2Ø	9.0	0.3	500
S1-CUL.06	0.25	1,704.7	1.13	1.5Ø	21.8	0.3	306.7
S1-CUL.07	0.25	1,704.7	1.13	1.5Ø	15.2	0.3	489.7
S1-CUL.08	0.52	1,681.5	3.35	2.5 x 2.2	27.9	0.5	20

Culvert Ref	Catchment Area (km^2)	SAAR (mm)	Design Flow (Q100 + 20% CCA)	Culvert Diameter (m) / Width (m) x Height (m)	Length (m)	Depth of Embedment (m)	Culvert Gradient (1:x)
S1-CUL.09	0.52	1,681.5	3.35	1.8Ø	37.4	0.3	23
S1-CUL.10	0.77	1,681.5	8.13	2.5 x 2.5	34.8	0.5	324.8
S1-CUL.11	0.77	1,681.5	8.13	2.75 x 2.25	6.9	0.5	285.8
S1-CUL.12	0.83	1,347.6	2.91	1.8 x 1.8	18.3	0.5	51.3
S1-CUL.13	0.83	1,347.6	2.91	2.5 x 1.8	26.7	0.5	177.8
S1-CUL.14	4.98	1,372.1	20.77	6.0 x 2.5	8.5	0.5	21.3
S1-CUL.15	0.21	1,704.7	0.69	1.2Ø	110.5	0.3	85.5
S1-CUL.16	0.21	1,704.7	0.69	1.2Ø	81.9	0.3	15.4
S1-CUL.17	0.21	1,704.7	0.69	1.2Ø	13.9	0.3	49.1
S1-CUL.18	0.32	1,704.7	1.1	1.5Ø	33.1	0.3	465.7
S1-CUL.19	1.52	1,289.4	7.02	2.8 x 2.1	25.1	0.5	62.3
S1-CUL.20	1.52	1,289.4	7.02	2.8 x 2.1	12.3	0.5	81.6
S1-CUL.21	1.74	1,289.4	7.95	3.5 x 2.1	56.7	0.5	99.5
S1-CUL.22	2.41	1,289.4	10.73	4.5 x 2.2	56.5	0.5	29.7
S1-CUL.23	0.17	1,704.7	0.47	1.2Ø	84.4	0.3	15.3
S1-CUL.23A	0.04	1,704.7	0.15	1.2Ø	78.9	0.3	42.3
S1-CUL.24	0.04	1,704.7	0.15	1.2Ø	86.9	0.3	28.2
S1-CUL.25	5.32	1,251.9	18.76	5.0 x 4.5	76.6	0.5	1,298.3
S1-CUL.26	0.23	1,704.7	0.83	1.5Ø	7.8	0.3	489.2
S1-CUL.27	0.26	1,704.7	0.85	1.5Ø	32.0	0.3	53.5
S1-CUL.28	5.88	1243	15.41	Twin culverts 2.3 x 2.7 each	34.0	0.3	10
S1-CUL.29	0.5	1,260.3	1.76	1.5Ø	73.5	0.3	87.4
S1-CUL.30	1.64	1,260.3	5.27	2.4 x 2.1	87.2	0.5	76.4
S1-CUL.31	2.84	1,312.4	11.48	4.5 x 2.2	45.4	0.5	458.1
S1-CUL.32	0.92	1,260.3	3.09	1.8Ø	22.5	0.3	499.2
S1-CUL.33	0.92	1,260.3	3.09	2.0 x 2.0	46.2	0.5	502.6
S1-CUL.34	1.04	1,360.2	5.42	3.5 x 2	42.2	0.5	502.4
S1-CUL.35	1.04	1,360.2	5.42	3.5 x 2	26.9	0.5	498.2
S1-CUL.36	1.04	1,360.2	5.42	3.5 x 2	30.7	0.5	479.2
S1-CUL.37	0.21	1,704.7	1.39	1.5Ø	6.9	0.3	33.6
S1-CUL.38	0.21	1,704.7	1.39	1.5Ø	20.0	0.3	33.6

11.5.1.2 Bridge Crossings

There are three bridge structures proposed along the mainline carriageway of Section 1, namely, River Finn Crossing (N15R024), Backlees River Crossing (N15R042) and Cloghroe River Crossing (N13R085).

Table 11-32 presents locations and bridge types and their span/ length details. Hydraulic designs of these bridge openings have been carried out through building Hydrological Engineering Centre River Analysis System (HEC-RAS) hydraulic model for the relevant watercourses. Further details of the hydrologic and hydraulic modelling results are provided in Appendix C11.01. The locations of these bridge crossings are illustrated in Figure 11-3.

Table 11-32: Section 1 Proposed Bridge Schedule

Bridge Reference	Chainage	Referenced Mainline / Side Road	Location X	Location Y	Structure Type	Approx. Length (m)
River Finn Bridge	CH2+400	Mainline	612485.6	895001.8	7 Span Bridge	360
Backlees River Crossing	CH4+150	Mainline	613890.5	896001.5	Single Span Bridge	45
Cloghroe River Crossing	CH0+300	N15 Tie-in South	616020.3	900024.9	Single Span Bridge	18

11.5.1.3 Stream Diversions

At several locations, the existing natural flow paths are proposed to be altered slightly to suitably align the proposed culvert crossings with the road alignment.

In addition, the Cloghroe River Bridge requires instream works during construction for a permanent river realignment. The proposed realignment reach has existing patchy salmonid spawning, but mainly nursery habitat, although productivity is low owing to historic deepening and high shade (tunnelling). The diversion has been designed into the Proposed Development to match pre-existing morphology (refer to EIAR Drawing 4.16 in Volume D: Book of Drawings). Bridge abutments will be a minimum of 5 m from the bank of the newly diverted channel. These diversion works have been designed such that there will be no changes in the existing hydrological or morphological regimes of the relevant watercourses. Refer to Chapter 4: Project Description for further details of stream diversions. Refer to Chapter 9B: Biodiversity – Aquatic, Section 6.1.1 for mitigation of hydromorphological impacts of stream diversions/channel realignments.

11.5.1.4 Road Surface and Sub-Grade Water Drainage

Carriageway Drainage Network

Chapter 4: Project Description provides details of the road network associated with each outfall for Section 1. For the mainline carriageway a total of seven drainage networks have been proposed, while for the side roads 16 no. separate drainage networks have been proposed. Road runoff from the drainage network will initially discharge into 22 no. attenuation ponds and then into the existing natural watercourses via 22 no. outfalls. One drainage work for a side road will discharge into the infiltration pond in the absence of any surface watercourse in its vicinity. Figure 11-25 illustrates the locations of all outfalls.

HEWRAT Water Quality Risk Assessments

The Highways England Water Risk Assessment Tool (HEWRAT) was used to assess the risks posed by routine road runoff to streams and rivers. Based on the Annual Average Daily Traffic (AADT) and typical Standard Average Annual Rainfall (SAAR) values, the tool calculates the runoff pollutant concentrations associated with a ten-year series of rainfall events and the coincident flow in the receiving watercourse during each event. The tool displays either a Pass or Fail for each of the pollutant types considered.

Table 11-33 presents the HEWRAT individual assessment results for the Section 1 outfalls. Table 11-34 and Table 11-35 presents the HEWRAT combined analysis for soluble pollutants results for the Section 1 outfalls and combined analysis for sediment bound pollutants results for the Section 1 outfalls respectively. These results show that all outfalls pass the HEWRAT criteria for copper and zinc concentrations and non-accumulation of sediment velocity (at low flow) downstream of outfalls. The results also demonstrate that all relevant outfalls pass the HEWRAT cumulative assessment, i.e., at locations where there is more than one discharge on the same reach of a watercourse. All outfalls also pass the assessment relating to Environmental Quality Standards (EQS) in terms of annual average concentration (µg/l) limits for copper and zinc.

Treatment of Run-off and Accidental Spillage

In accordance with DN-DNG-03065-(HD 45) Road Drainage and the Water Environment (TII, 2015h) a serious spillage pollution risk assessment as per Method D of Appendix A was carried out for each of the drainage networks discharging to surface watercourses and groundwater bodies. This assessment calculates the probability of a spillage with potential to cause a serious PINC occurring and the probability of that spillage causing a PINC assuming it occurs.

The results of the spillage risk assessment for Section 1 are presented in Table 11-35. The results show that annual probability of a serious PINCs range from 0.001% to 0.037% which are well below the acceptable risk limit of 0.5%. This suggests that no formal oil/petrol interceptors are required on Section 1 of the Proposed Development and that hydrocarbon removal can be achieved through the hybrid wetland systems.

Table 11-33: Section 1 HEWRAT Individual Analysis Results for all Outfalls

Outfall Ref. No.	Location			HEWRAT Parameters				Results		
	Easting	Northing	Outfall Stream/EPA Segment Code	AADT (nr/year)	Rainfall SAAR (mm)	BFI	Q_{95} (m^3/s)	Annual average concentration		Sediment accumulation
								Copper (µg/l)	Zinc (µg/l)	
1	616,290.71	899,943.80	Magheracorran River (01_1530)	>10,000 and <50,000	1,312	0.3675	0.043	0.12 (Pass)	0.36 (Pass)	0.07 m/s (Pass)
2	616,008.33	899,645.63	Magheracorran River (01_1024)		1,257	0.4974	0.048	0.01 (Pass)	0.03 (Pass)	0.08(Pass)
3	616,025.54	897,050.45	Tircallan (01_3)		1,289	0.3441	0.011	1.28 (Pass)	0.87 (Pass)	0.31 m/s (Pass)
4	616,334.30	895,098.87	Mullaghagarry River (01_776)		1,243	0.3965	0.011	1.53 (Pass)	0.21 (Pass)	0.25 m/s (Pass)
5	616,610.79	895,150.89	Mullaghagarry River (01_776)		1,243	0.3965	0.011	1.49 (Pass)	0.08 (Pass)	0.02 m/s (Pass)
6	614,288.09	896,093.34	Greenhills 01(01_70)		1,372	0.3307	0.012	1.1 (Pass)	0.60 (Pass)	0.09 m/s (Pass)
7	613,868.95	896,024.06	Backlees (01_186)		1,374	0.3304	0.012	1.04 (Pass)	0.1 (Pass)	0.03 m/s (Pass)
8	613,059.73	895,468.45	Drumboe_Lower (01_589)		1,352	0.510	0.0329	1.08 (Pass)	0.23 (Pass)	0.24 m/s (Pass)
9	612,742.79	895,053.33	River Finn (01_590)		1,989	0.2968	1.716	1.01 (Pass)	0 (Pass)	0.14 m/s (Pass)
10	612,442.55	894,995.98	River Finn (01_810)		1,995	0.297	1.728	1.01 (Pass)	0 (Pass)	0.14 m/s (Pass)
11	611,887.78	895,216.90	River Finn (01_810)		1,997	0.2849	1.728	1.01 (Pass)	0 (Pass)	0.14 m/s (Pass)
12	611,208.69	893,488.44	Cappry (01_1816)		1,681	0.3397	0.007	1.51 (Pass)	0.16 (Pass)	0.01 m/s (Pass)
13	611,208.69	893,488.44	Cappry (01_1816)		1,681	0.3397	0.007	1.74 (Pass)	0.89 (Pass)	0.18 m/s (Pass)
14	610,847.52	893,052.81	(Burn) Daurnett (01_1815)		1,699	0.3352	0.034	1.51 (Pass)	0.13 (Pass)	0.78 m/s (Pass)

Outfall Ref. No.	Location			HEWRAT Parameters				Results		
	Easting	Northing	Outfall Stream/EPA Segment Code	AADT (nr/year)	Rainfall SAAR (mm)	BFI	Q_{95} (m^3/s)	Annual average concentration		Sediment accumulation
								Copper (µg/l)	Zinc (µg/l)	
15	616,496.32	895,900.87	Mullaghagarry River (01_68)		1,244	0.3968	0.011	1.61 (Pass)	0.47 (Pass)	0.24 m/s (Pass)
16	616,578.64	895,221.80	Mullaghagarry River (01_776)		1,242	0.3965	0.011	1.54 (Pass)	0.24 (Pass)	0.02 m/s (Pass)
17	614,728.39	898,128.23	Teevickmoy (01_185)		1,377	0.3286	0.001	1.13 (Pass)	0.39 (Pass)	0.03 m/s (Pass)
18	616,711.71	896,278.44	Castlebane 01 (01_67)		1,248	0.3976	0.0004	1.6 (Pass)	0.44 (Pass)	0.01 m/s (Pass)
19	616,266.95	899,331.62	Lisnaree (01_928)		1,260	0.4638	0.006	0.04 (Pass)	0.1 (Pass)	0.04 m/s (Pass)
20	611,566.04	893,776.56	Cappry (01_1816)		1,681	0.3397	0.007	1.5 (Pass)	0.11 (Pass)	0.01 m/s (Pass)
21	616,312.63	900,190.26	Cloghroe 01 (01_1796)		1,508	0.3197	0.037	0.01 (Pass)	0.03 (Pass)	0.01 m/s (Pass)

Outfall No. 22 does not receive runoff from any mainline or national road infrastructure. As the discharge is to a local stream, a HEWRAT assessment is not required.

Table 11-34: Section 1 HEWRAT Cumulative Assessment

Outfall Ref. No.	Location			HEWRAT Parameters				Results		
	Easting	Northing	Outfall Stream/EPA Segment Code	AADT (nr/year)	Rainfall SAAR (mm)	BFI	Q_{95} (m^3/s)	Annual average concentration		Sediment accumulation
								Copper (µg/l)	Zinc (µg/l)	
4	616,334	895,098	Mullaghagarry River (01_776)	>10,000 and <50,000	1,243	0.2976	0.011	1.58 (Pass)	0.4 (Pass)	0.25 m/s (Pass)
5	616,611	895,151	Mullaghagarry River (01_776)		1,243	0.3965	0.011	1.61 (Pass)	0.48 (Pass)	0.24 m/s (Pass)
10	612,442	894,996	River Finn (01_810)		1,995	0.297	1.728	1.01 (Pass)	0.01 (Pass)	0.14 m/s (Pass)
12	611,208	893,488	Cappry (01_1816)		1,681	0.3397	0.007	1.77 (Pass)	1 (Pass)	0.18 m/s (Pass)
20	611,566	893,776	Cappry (01_1816)		1,681	0.3397	0.007	1.79 (Pass)	1.07	0.18 m/s (Pass)

Table 11-35: Section 1 Serious Spillage Pollution Risk Assessment

Section 1 Drainage Reference	Annual Probability of Spillage (Pspl)	Probability of a Serious PINC Arising as a Result of a Spillage (Ppol)	Annual Probability of a Serious PINC (%)
S1-ML-DN-01	0.000612	0.6	0.037
S1-ML-DN-02	0.000208	0.6	0.012
S1-ML-DN-03	0.000227	0.6	0.014
S1-ML-DN-04	0.000164	0.6	0.001
S1-ML-DN-05	0.000145	0.6	0.009
S1-ML-DN-06	0.000216	0.6	0.013
S1-ML-DN-07	0.000355	0.6	0.021
S1-SR-DN-01	0.000095	0.6	0.006
S1-SR-DN-03	0.000045	0.3	0.001
S1-SR-DN-06	0.000328	0.6	0.02
S1-SR-DN-07	0.000080	0.6	0.005
S1-SR-DN-09	0.000031	0.6	0.002
S1-SR-DN-10	0.000268	0.6	0.016
S1-SR-DN-11	0.000085	0.6	0.005
S1-SR-DN-16	0.000092	0.6	0.006

Pre-Earthworks Drainage

Interceptor ditches will be located so as to fully intercept any overland flow from the natural catchments adjacent to the Proposed Development, during both the construction and the operational phase. The ditches have been sized to cater for a 1 in 75-year return period as per DN-DNG-03064 (HD 106) (TII, 2015e) Drainage of Runoff from Natural Catchments.

The interceptor ditches will be required to collect surface water runoff at the top of the cuttings or the base of the embankments where the adjacent land falls towards the Proposed Development. The interceptor ditches will prevent surface water from adjacent land from flowing onto the proposed works and prevent ponding of water at the toe of the embankments. Any land drains that are interrupted by the new works will be diverted or discharged into an interceptor ditch. Interceptor ditches will generally discharge into existing land drains, streams, and rivers when possible.

Cross-drains will be provided to convey flow from the interceptor ditches beneath the Proposed Development to the outfall/discharge locations where required.

In the absence of watercourses, the pre-earthworks interceptor ditches will discharge direct to ground via stone filled infiltration trenches.

Park and Share

At Chainages 0+000 (Mainline 1.1), 1+750 (Mainline 1.2) and 0+150 (Mainline 1.3) there are park and share facilities to service the proposed greenway and public transportation. The parking facilities include landscaped areas which will be planted. The surface water runoff from the parking areas will be disposed of through the use of a combination of permeable paving, rain gardens and tree pits.

11.5.2 Section 2 Proposed Surface Water Drainage

In Section 2, there are a total of 37 No. culverts for watercourse crossings and two river bridges. A 234 long three-Span bridge is proposed over River Swilly at Letterkenny. The river has an upstream catchment area of 96.76 km^2 at this location. The N13R034 is an existing River Bridge (buried multi culvert type structure) over Isle Burn (EPA water name “Leslie Hill Stream”). The Isle Burn River has an upstream catchment area of 55 km^2 at the proposed crossing. No changes are proposed for the existing Isle Burn crossing, but a foot bridge will be attached to the southern side with no instream works requirement. All crossings have been designed considering the hydraulic requirements for road crossings.

11.5.2.1 Culverts

There are 37 No. culverts for watercourse crossings. Figure 11-13 illustrates the location of these culverts. Culvert locations are further detailed in Chapter 4: Project Description. Table 11-36 tabulates the culvert design parameters within Section 2. Culverts or pipes with a clear span greater than 2.0 m are classified as structures in accordance with the DN-STR-03001 (BD 2).

All culverts were sized based on the calculations set out in the updated CIRIA Culvert, Screen and Outfall Manual (2019), CIRIA Report No. C786.

Table 11-36: Section 2 Culvert Design Parameters

Culvert Ref	Catchment Area (km^2)	SAAR (mm)	Design Flow (Q100 20% CCA)	Culvert Diameter (m)/Width(m) X Height(m)	Length (m)	Depth of Embedment (m)	Culvert Gradient (1:x)
S2-CUL.01	0.06	1215.9	0.130	1.2Ø	26.3	0.3	28.7
S2-CUL.02	0.06	1215.9	0.139	1.2Ø	8.047	0.3	6.2
S2-CUL.03	0.06	1215.9	0.139	1.2Ø	40.840	0.3	128.0

Culvert Ref	Catchment Area (km^2)	SAAR (mm)	Design Flow (Q100 20% CCA)	Culvert Diameter (m)/Width(m) X Height(m)	Length (m)	Depth of Embedment (m)	Culvert Gradient (1:x)
S2-CUL.04	0.06	1215.9	0.139	1.2Ø	8.324	0.3	108.1
S2-CUL.05	0.05	1215.9	0.136	1.2Ø	20.086	0.3	499.6
S2-CUL.06	0.09	1215.9	0.221	1.2Ø	55.443	0.3	37.6
S2-CUL.07	0.29	1215.9	0.507	1.2Ø	20.371	0.3	83.1
S2-CUL.08	0.29	1215.9	0.507	1.2Ø	20.191	0.3	26.9
S2-CUL.09	0.29	1215.9	0.507	1.2Ø	32.717	0.3	79.8
S2-CUL.10	0.19	1215.9	0.441	1.2Ø	10.144	0.3	10.1
S2-CUL.11	0.20	1215.9	0.480	1.2Ø	21.152	0.3	70.5
S2-CUL.12	0.24	1215.9	0.415	1.2Ø	28.139	0.3	281.4
S2-CUL.13	0.34	1215.9	0.616	1.5Ø	45.669	0.3	374.3
S2-CUL.14	0.11	1215.9	0.270	1.2Ø	45.915	0.3	499.1
S2-CUL.15	0.11	1215.9	0.270	1.2Ø	10.000	0.3	500.0
S2-CUL.16	0.80	1137.71	2.820	1.25 x 1.75	52.64	0.5	11.0
S2-CUL.16A	0.80	1137.71	2.820	1.75 x 1.75	59.1	0.5	51.4
S2-CUL.17	1.15	1137.71	3.950	2.5 x 2.0	8.96	0.5	90.5
S2-CUL.18	1.24	1137.71	4.240	2.9 x 2.1	83.070	0.5	276.9
S2-CUL.19	1.24	1137.71	4.240	2.9 x 2.5	34.500	0.5	65.7
S2-CUL.20	1.33	1137.71	4.520	2.9 x 3.3	65.032	0.5	168.9
S2-CUL.21	0.20	1215.9	0.383	2.0 x 3.2	48.406	0.5	444.1
S2-CUL.22	0.32	1215.9	0.584	2.5 x 3.4	25.419	0.5	334.5
S2-CUL.23	0.32	1215.9	0.584	3.3 x 3.5	71.011	0.5	438.3
S2-CUL.24	0.14	1215.9	0.215	1.25 x 1.35	67.670	0.5	284.3
S2-CUL.25	0.26	1215.9	0.252	2.0 x 2.5	95.214	0.5	857.7
S2-CUL.26	0.07	1215.9	0.149	1.5 x 2.6	41.017	0.5	156.6
S2-CUL.27	0.08	1215.9	0.181	1.2Ø	31.335	0.3	482.1
S2-CUL.27A	0.04	1215.9	0.098	1.2Ø	13.490	0.3	269.8
S2-CUL.27B	0.04	1215.9	0.098	1.2Ø	20.400	0.3	408.0
S2-CUL.28	0.35	1215.9	0.743	1.5Ø	35.500	0.3	23.3
S2-CUL.29	0.93	1135.91	2.950	3.5 x 2.0	26.553	0.5	53.1
S2-CUL.30	0.93	1135.91	2.950	3.5 x 2.0	37.919	0.5	379.2
S2-CUL.31	0.93	1135.91	2.950	3.5 x 2.0	66.879	0.5	27.3
S2-CUL.32	1.54	1135.91	7.540	3.5 x 4.0	79.190	0.5	92.9
S2-CUL.33	0.23	1215.9	0.482	1.2Ø	89.350	0.3	20.1
S2-CUL.34	1.02	1136.13	2.500	1.8Ø	75.700	0.3	232.2

11.5.2.2 Bridge Crossings

There are two bridge structures proposed along the mainline carriageway of Section 2, namely, River Swilly Crossing and an existing River Bridge over Isle Burn (buried multi culvert type structure) N13R034. Table 11-37 presents locations and bridge types and their span/lengths details. Hydraulic designs of these bridge openings have been carried out through developing a HEC-RAS hydraulic model for the relevant watercourses. Further details of the hydrologic and hydraulic modelling results are provided in Appendix C11.02. The locations of these bridge crossings are illustrated in Figure 11-25.

Table 11-37: Section 2 Proposed Bridge Schedule

Bridge Reference	Chainage	Referenced Mainline/Side Road	Location X	Location Y	Structure Type	Approx. Length (m)
River Swilly Bridge	CH0+520	Mainline	619,068.739	911,693.472	Three Span Bridge	235
N13R034	CH3+400	Mainline	623,059.943	910,836.499	Single Span Bridge	40

11.5.2.3 Stream Diversions

At several locations, the existing natural flow paths are proposed to be altered slightly in order to suitably align the proposed culvert crossings with the road alignment. These diversion works have been designed such that there will be no changes in the existing hydrological or morphological regimes of the relevant watercourses. Refer to Chapter 4: Project Description for further details of these diversion works. Refer to Chapter 9B: Biodiversity – Aquatic, Section 6.1.1 for mitigation of hydromorphological impacts of stream diversions/channel realignments

11.5.2.4 Road Surface and Sub-Grade Water Drainage

Carriageway Drainage Network

Chapter 4: Project Description provides details of the road network associated with each outfall for Section 2. For the mainline carriageway a total of two drainage networks have been proposed, while for the side roads ten separate drainage networks have been proposed. Road runoff from the drainage network will initially be discharged into 12 no. attenuation ponds and then into the existing natural watercourses via 12 no. outfalls. Figure 11-25 illustrates the locations of all outfalls.

HEWRAT Water Quality Risk Assessments

The HEWRAT was utilised to assess the risks posed by routine road runoff to streams and rivers. Based on the AADT and typical Standard Average Annual Rainfall (SAAR) values, the tool calculates the runoff pollutant concentrations associated with a ten-year series of rainfall events and the coincident flow in the receiving watercourse during each event. The tool displays either a Pass or Fail for each of the pollutant types considered.

Table 11-38 presents the HEWRAT assessment results for the Section 2 outfalls. Table 11-39 presents the HEWRAT Combined Analysis for Soluble Pollutants Results for the Section 2 outfalls. These results show that all outfalls pass the HEWRAT criteria for copper and zinc concentrations and non-accumulation of sediment velocity (at low flow) downstream of outfalls. The results also demonstrate that all relevant outfalls pass the HEWRAT cumulative assessment, i.e., at locations where there is more than one discharge on the same reach of a watercourse. All outfalls also pass the assessment relating to Environmental Quality Standards (EQS) in terms of annual average concentration (µg/l) limits for copper and zinc.

Table 11-38: Section 2 HEWRAT Analysis Results for All Outfalls

Outfall Ref. No.	Location			HEWRAT Parameters				Results		
	Easting	Northing	Outfall Stream/ EPA Segment Code	AADT (nr/year)	Rainfall SAAR (mm)	BFI	Q95 (m^3/s)	Annual Average Concentration		Sediment Accumulation
								Copper (µg/l)	Zinc (µg/l)	
1	620,014.4	908,275.508	A local watercourse which discharges to Magheraboy 39 River (39_471)	>10,000 and <50,000	1,145	0.5118	0.012	0.09 (Pass)	0.28 (Pass)	0.28 m/s (Pass)
2	619,207.8	909,103.96	A local watercourse which discharges to Lurgybrac		1,217	0.3446	0.002	0.29 (Pass)	0.86 (Pass)	0.05 m/s (Pass)
3	619,583.1	909,764.597	Coaghmill River (39_2151)		1,216	0.3489	0.0004	0.55 (Pass)	1.66 (Pass)	0.25 m/s (Pass)
4	619,536.1	910,832.264	A local stream which discharges into River Swilly (39-2724)		1,137	0.5092	0.217	1.23 (Pass)	0.01 (Pass)	0.01 m/s (Pass)
5	619,978.6	911,202.441	A local stream which discharges into River Swilly (39-2727)		1,137	0.5084	0.217	1.28 (Pass)	0.16 (Pass)	0.21 m/s (Pass)
6	619,238.2	911,551.28	A local stream which into discharges Corravaddy (Burn) (39_2468)		1,236	0.3473	0.027	0.07 (Pass)	0.19 (Pass)	0.1 m/s (Pass)
7	619,084.1	911,775.622	River Swilly (39_2718)		1,524	0.3237	0.217	1.23 (Pass)	0.01 (Pass)	0.01 m/s (Pass)
8	620,843.3	911,429.385	Farsetmore Stream via a local drain (39_2476)		1,136	0.5537	0.003	0.21(Pass)	0.64 (Pass)	0.01 m/s (Pass)
9	621,219	911,625.643	Farsetmore Stream (39_2476)		1,136	0.5537	0.003	0.74 (Pass)	2.27 (Pass)	0.13 m/s (Pass)
10	622,739.7	911,157.954	Magheramore 39 (39_576)		1,136	0.5615	0.017	0.04 (Pass)	0.13 (Pass)	0.06 m/s (Pass)
11	619,516.7	911,096.939	A local stream which discharges into River Swilly (39-2,724)		1,525	0.3237	0.217	1.23 (Pass)	0.01 (Pass)	0.01 m/s (Pass)
12	620,205.8	911,296.037	Dromore 39 (39_2,954)		1,138	0.508	0.0001	0.74 (Pass)	2.26 (Pass)	0.1 m/s (Pass)

Table 11-39: Section 2 HEWRAT Cumulative Assessment

Outfall Ref. No.	Location			HEWRAT Parameters				Results		
	Easting	Northing	Outfall Stream/EPA Segment Code	AADT (nr/year)	Rainfall SAAR (mm)	BFI	Q_{95} (m^3/s)	Annual average concentration		Sediment accumulation
								Copper (µg/l)	Zinc (µg/l)	
7	619,084.1	911,775.622	River Swilly (39_2718)	>10,000 and <50,000	1,524	0.3237	0.217	1.24 (Pass)	0.01 (Pass)	0.01 m/s (Pass)
9	621,219	911,625.643	Farsetmore Stream (39_2476)		1,136	0.5537	0.003	0.75 (Pass)	2.28 (Pass)	0.13 m/s (Pass)

Treatment of Run-off and Accidental Spillage

In accordance with DN-DNG-03065-(HD 45) Road Drainage and the Water Environment (TII, 2015h) a serious spillage pollution risk assessment as per Method D of Appendix A was carried out for each of the drainage networks discharging to surface watercourses and groundwater bodies. This assessment calculates the probability of a spillage with potential to cause a serious PINC occurring and the probability of that spillage causing a PINC assuming it occurs.

The results of the spillage risk assessment for Section 2 are presented in Table 11-40. The results show that Annual probability of a serious PINCs range from 0.002% to 0.084% which are well below the acceptable risk limit of 0.5%. This suggests that no formal oil/petrol interceptors are required for Section 2 of the Proposed Development and that hydrocarbon removal can be achieved through the hybrid wetland systems.

Table 11-40: Section 2 Serious Spillage Pollution Risk Assessment

Section 2 Drainage Reference	Annual Pspl	Probability of a Serious PINC arising as a Result of a Spillage (Ppol)	Annual Probability of a Serious PINC (%)
S2-ML-DN-01	0.001876	0.45	0.084
S2-ML-DN-02	0.000194	0.45	0.009
S2-SR-DN-05	0.000097	0.45	0.004
S2-SR-DN-06	0.000384	0.45	0.017
S2-SR-DN-07	0.000046	0.45	0.002

Pre-Earthworks Drainage

Interceptor ditches and cross-drains will be located so as to fully intercept any overland flow from the natural catchments adjacent to the Proposed Development, both during construction and the operational phase.

Approximately 121 m of infiltration trenches are proposed for Section 2. Furthermore, 37 no. cross drains, lengths ranging between 5.5 m and 68.9 m, with diameter ranging between 900 and 1,200 mm, across the mainline and connector/link roads are also proposed.

Park and Share

At Chainage 0+150 of Bonagee Link Road there are park and share facilities to service the proposed greenway and public transportation. The parking facilities include landscaped areas which will be planted. The surface water runoff from the pavement of the parking areas will be disposed of via the landscaped area through the use of SuDS features.

11.5.3 Section 3 Proposed Surface Water Drainage

In Section 3, there are 33 stream culverts, and three river bridges proposed. The design of these bridges and culverts has considered the hydraulic requirements of the OPW, the existing flooding in the vicinity and any ecological sensitivities in the region.

11.5.3.1 Culverts

There are 33 culverts proposed along the mainline/ connector/ link road carriageways. Table 11-41 lists these culverts along with their required size and lengths. Figure 11-25 illustrates the location of these culverts. Culverts or pipes with a clear span greater than 2.0 m are classified as structures in accordance with the DN-STR-03001 (BD 2). The design of the culverts is in accordance with the CIRIA Culvert, Screen and Outfall Manual (2019), CIRIA Report No. C786.

Table 11-41: Section 3 Culvert Design Parameters

Culvert Ref	Catchment Area (km^2)	SAAR (mm)	Design Flow (Q_{100} + 20% CCA)	Culvert Diameter (m) / Width (m) x Height (m)	Approx Length (m)	Depth of Embedment (m)	Culvert Gradient (1:x)
S3-CUL.01	0.77	1,078	3.73	4.0 x 3.0	25.8	0.5	200
S3-CUL.02	0.77	1,078	3.73	4.0 x 3.2	52.7	0.5	479
S3-CUL.03	0.77	1,078	3.73	4.0 x 4.0	66.8	0.5	417
S3-CUL.04	22.65	1,068	51.10	8.0 x 3.8	60.0	0.5	500
S3-CUL.05	22.65	1,068	51.10	8.0 x 3.6	58.0	0.5	500
S3-CUL.06	20.94	1,067	41.60	12.0 x 3.2	60.0	0.5	200
S3-CUL.07	13.5	1,067	24.04	4.2 x 3.5	69.5	0.5	200
S3-CUL.08	0.36	1,067	0.92	1.8 x 1.4	24.5	0.5	245
S3-CUL.09	0.40	1,067	1.00	1.8 x 1.4	60.0	0.5	245
S3-CUL.10	1.056	1,069	2.15	2.0 x 1.8	53.5	0.5	200.0
S3-CUL.11	1.056	1,069	2.15	2.0 x 1.7	19.0	0.5	200.0
S3-CUL.12	0.45	1,067	1.07	1.2	62.0	0.3	190.0
S3-CUL.13	0.45	1,067	1.07	1.2	31.8	0.3	100.0
S3-CUL.14	2.778	1,072	6.50	4.2 x 1.9	23.2	0.5	100.0
S3-CUL.15	2.778	1,072	6.50	3.7 x 2.2	60.0	0.5	111.1
S3-CUL.16	2.778	1,072	6.50	3.7 x 2.3	22.7	0.5	303.0
S3-CUL.17	0.346	1,067	0.66	1.2	49.8	0.3	151.5
S3-CUL.18	1.26	1,068	2.29	2.0 x 1.8	48.4	0.5	166.6
S3-CUL.19	1.26	1,068	2.29	2.0 x 1.8	36.0	0.5	200.0
S3-CUL.20	2.26	1,054	4.34	3.2 x 1.9	60.0	0.5	200.0
S3-CUL.20A	2.26	1,054	4.34	3.2 x 1.9	25.0	0.5	200.0
S3-CUL.21	0.576	1,053	1.58	2.8 x 1.4	16.5	0.5	263.2
S3-CUL.22	0.576	1,053	1.58	2.8 x 1.5	34.6	0.5	117.9
S3-CUL.23	0.576	1,053	1.58	2.2 x 1.5	23.6	0.5	230.7
S3-CUL.24	7.96	1,054	15.50	6.0 x 2.5	23.0	0.5	197.2
S3-CUL.25	1.14	1,052	2.6	2.0 x 1.9	50.2	0.5	153.0
S3-CUL.26	1.14	1,052	2.6	2.2 x 1.9	47.2	0.5	251.0
S3-CUL.27	9.85	1,052	19.38	9.5 x 2.85	36.2	0.5	236.0
S3-CUL.29	1.64	1,047	4.66	2.8 x 2.2	58.0	0.5	200.0
S3-CUL.30	0.71	1,038	2.62	2.0 x 1.8	66.0	0.5	290.0
S3-CUL.31	0.71	1,038	2.11	1.8 x 1.8	60.0	0.5	66.0
S3-CUL.32	0.2	1,299	0.52	1.2	44.5	0.3	200.0
S3-CUL.33	0.23	1,296	0.60	1.2	50.7	0.3	27.8

11.5.3.2 Bridge Crossings

There are three bridge structures proposed along the mainline carriageway of Section 3. These include the River Finn Bridge, Swilly Burn Bridge and River Deele Bridge. Table 11-42 presents the locations and bridge types and their span/lengths details. The bridge openings have been determined by building hydraulic models of the structure and the watercourse and conducting detailed analysis. Refer to the Flood Risk Assessment in Appendix C11.03 for further details of the hydraulic models. The locations of these bridge crossings are illustrated in Figure 11-25. At the River Deele Bridge, in addition to the main structure, there are four flood relief culverts to the north of the bridge which have been modelled to allow continuity of flow across the flood plain.

Table 11-42: Section 3 Bridge Crossings

Bridge Reference	Chainage	Referenced Mainline / Side Road	Location X	Location Y	Structure Type	Approx. Length (m)
River Finn Bridge	CH 17+500	Mainline	632,522	896,998	Eight span Bridge	287
Swilly Burn Bridge	CH 11+500	Mainline	629,456	902,076	Single Span Bridge	30
River Deele Bridge	CH 14+400	Mainline	631,119	889,719	Three Span Bridge	140

11.5.3.3 Stream Diversions

At several locations, the existing natural flow paths are proposed to be altered slightly in order to suitably align the proposed culvert crossings with the road alignment.

In addition, the Swilly Burn tributary (EPA name Drumbeg, Site W3-12) at Tullyrap will require an extensive realignment over a total length of approx. 1km (Ch.9+200 to 10+200). The existing N14 at this location will be realigned to the east of the proposed new road to avoid requirement for a series of extensive culverts. The proposed realignment will be to the west of the proposed road and adequate land take has been included to create a meandering channel which is marked “Tullyrap Water Diversion” in the General Arrangement EIAR Drawing 4.3 (sheets 5 and 6 of 10) and Drainage Layout EIAR Drawings 4.42 (sheets 5 and 6 of 10) in Volume D: Book of Drawings. The latter drawing series shows the newly created channel with morphology designed to mimic ‘natural’ and the location of proposed culverts S3-CUL-24, S3-CUL-25 and S3-CUL-26 (refer to Appendix 9B.04 for construction phase details for culverts). These diversion works have been designed such that there will be no adverse changes to the existing hydrological or morphological regimes of the relevant watercourses.

11.5.3.4 Road Surface and Sub-Grade Water Drainage

Carriageway Drainage Network

Chapter 4: Project Description provides details of the road network associated with each outfall for Section 3. For the mainline carriageway a total of 13 No. drainage networks are proposed, while for the side roads 23 No. separate drainage networks are proposed. Road runoff from the drainage network will initially be discharged into 22 No. attenuation ponds and then into the existing natural watercourses via 18 no. outfalls. One drainage network for a side road will discharge into the infiltration pond in the absence of any surface watercourse in its vicinity. Figure 11-25 illustrates the locations of all outfalls.

Proposed Outfalls and Attenuation of Run-off

Chapter 4: Project Description provides details of the proposed outfalls and attenuation ponds. Surface water discharge from attenuation facilities will be released at a rate so as not to increase flooding downstream of any discharge point up to the 1 in 100-year return period storm event. Discharge will be provided from the attenuation facilities at the green-field runoff rate. In Section 3, 16 No. outfalls have been proposed. All outfalls where discharge is to surface water and where attenuation ponds will be required are provided in Chapter 4: Project Description.

Figure 11-25 illustrates the locations of these outfalls. Flood compensatory measures will be provided where the provision of the attenuation pond reduces the area available to flood in the current scenario.

HEWRAT Water Quality Risk Assessments

The HEWRAT was utilised to assess the risks posed by routine road runoff to streams and rivers. Based on the AADT and typical Standard Average Annual Rainfall (SAAR) values, the tool calculates the runoff pollutant concentrations associated with a ten-year series of rainfall events and the coincident flow in the receiving watercourse during each event. The tool displays either a Pass or Fail for each of the pollutant types considered.

Table 11-43 presents the HEWRAT assessment results for the Section 3 outfalls. Table 11-44 presents the HEWRAT Combined Analysis for Soluble Pollutants Results for the Section 3 outfalls. These results show that all outfalls pass the HEWRAT criteria for copper and zinc concentrations and non-accumulation of sediment velocity (at low flow) downstream of outfalls. The results also demonstrate that all relevant outfalls pass the HEWRAT cumulative assessment, i.e., at locations where there is more than one discharge on the same reach of a watercourse. All outfalls also pass the assessment relating to Environmental Quality Standards (EQS) in terms of annual average concentration (µg/l) limits for copper and zinc.

Table 11-43: Section 3 HEWRAT Analysis Results for all Mainline Outfalls

Outfall Ref. No.	Location			HEWRAT Parameters				Results		
	Easting	Northing	Outfall Stream/EPA Segment Code	AADT (nr/year)	Rainfall SAAR (mm)	BFI	Q95 (m^3/s)	Annual Average Concentration		Sediment accumulation
								Copper (µg/l)	Zinc (µg/l)	
1	623,272	910,822	Lesley Hill Stream	>10,000 and <50,000	1,220	0.568	0.2	0.09 (Pass)	0.41 (Pass)	0.12 m/s (Pass)
2	623,855	910,481	Lesley Hill Stream_020		1,183	0.587	0.090	0.050 (Pass)	0.150 (Pass)	0.20 m/s (Pass)
4	625,253	910,023	Lesley Hill Stream_020		1,164	0.563	0.047	0.050 (Pass)	0.160 (Pass)	0.27 m/s (Pass)
6	625,533	909,608	Lesley Hill Stream_020		1,170	0.563	0.053	0.080 (Pass)	0.250 (Pass)	0.35 m/s (Pass)
7	626,614	908,368	Lesley Hill Stream_020		1,160	0.568	0.028	0.130 (Pass)	0.390 (Pass)	0.24 m/s (Pass)
9	627,740	906,533	Swilly Burn_030		1,106	0.584	0.014	0.150 (Pass)	0.460 (Pass)	0.21 m/s (Pass)
10	627,979	905,563	Swilly Burn_030		1,106	0.584	0.014	0.160 (Pass)	0.500 (Pass)	0.16 (Pass)
13	629,262	903,530	Swilly Burn_030		1,101	0.584	0.021	0.200 (Pass)	0.630 (Pass)	0.15 (Pass)
14	629,646	902,295	Swilly Burn_020		1,078	0.585	0.059	0.100 (Pass)	0.310 (Pass)	0.11 (Pass)
15	631,271	899,774	Deele_050		1,283	0.394	0.293	0.010 (Pass)	0.050 (Pass)	0.76 (Pass)
16	630,792	899,969	Deele_050		1,289	0.394	0.282	0.010 (Pass)	0.030 (Pass)	0.39 (Pass)
17	632,582	897,219	River Finn		1,668	0.334	1.896	0.020 (Pass)	0.050 (Pass)	0.97 (Pass)

Table 11-44: Section 3 HEWRAT Cumulative Assessment

Outfall Ref. No.	Location			HEWRAT Parameters				Results		
	Easting	Northing	Outfall Stream/EPA Segment Code	AADT (nr/year)	Rainfall SAAR (mm)	BFI	Q95 (m^3/s)	Annual Average Concentration		Sediment accumulation
								Copper (µg/l)	Zinc (µg/l)	
7	626,614	908,368	Lesley Hill Stream_020	>10,000 and <50,000	1,160	0.568	0.028	0.130 (Pass)	0.390 (Pass)	0.24 m/s (Pass)
13	629,262	903,530	Swilly Burn_030		1,101	0.584	0.021	0.200 (Pass)	0.630 (Pass)	0.15 (Pass)

Treatment of Run-off and Accidental Spillage

In accordance with DN-DNG-03065-(HD 45) Road Drainage and the Water Environment (TII, 2015) a serious spillage pollution risk assessment as per Method D of Appendix A was carried out for each of the drainage networks discharging to surface watercourses and groundwater bodies. This assessment calculates the probability of a spillage with potential to cause a serious PINC occurring and the probability of that spillage causing a PINC assuming it occurs.

The results of the spillage risk assessment for Section 3 are presented Table 11-45. The results show that annual probability of a serious PINCs range from 0.001% to 0.037% which are well below the acceptable risk limit of 0.5%. This suggests that no formal spillage containment are required on Section 3 of the Proposed Development and that hydrocarbon removal can be achieved through the hybrid wetland systems. Refer to Chapter 4: Project Description for detailed description about hybrid wetlands.

Table 11-45: Section 3 Serious Spillage Pollution Risk Assessment

Section 3 Drainage Reference	Annual Pspl	Probability of a Serious PINC arising as a Result of a Spillage (Ppol)	Annual probability of a serious PINC (%)
S3-ML-DN-01	0.001	0.75	0.080
S3-ML-DN-02	0.00004	0.75	0.003
S3-ML-DN-03	0.00006	0.75	0.004
S3-ML-DN-04	0.00002	0.75	0.002
S3-ML-DN-05	0.00006	0.75	0.004
S3-ML-DN-06	0.00003	0.75	0.0002
S3-ML-DN-07	0.00003	0.75	0.0002
S3-ML-DN-08	0.00007	0.75	0.0005
S3-ML-DN-09	0.00008	0.75	0.006
S3-ML-DN-10	0.00008	0.75	0.006
S3-ML-DN-11	0.00004	0.75	0.003
S3-ML-DN-12	0.00009	0.75	0.007
S3-ML-DN-13	0.0007	0.75	0.06

Pre-Earthworks Drainage

Interceptor ditches will be located so as to fully intercept any overland flow from the natural catchments adjacent to the Proposed Development, both during construction and the operational phase. The ditches have been sized to cater for a 1 in 75-year return period as per DN-DNG-03064 (HD 106) (TII, 2015e) Drainage of Runoff from Natural Catchments.

The interceptor ditches will be required to collect surface water runoff at the top of the cuttings or the base of the embankments where the adjacent land falls towards the Proposed Development. The interceptor ditches will prevent surface water from adjacent land from flowing onto the proposed works and prevent ponding of water at the toe of the embankments. Any land drains that are interrupted by the new works will be diverted or discharged into an interceptor ditch. Interceptor ditches will generally discharge into existing land drains, streams, and rivers when possible.

In the absence of watercourses, the pre-earthworks interceptor ditches will discharge direct to ground via stone filled infiltration trenches.

Cross-drains will be provided to convey flow from the interceptor ditches beneath the Proposed Development to the outfall/discharge locations where required.

Park and Share

At Chainages 0+100, 7+600, 14+000 and 17+500 there are park and share facilities to service the proposed greenway and public transportation. The parking facilities include landscaped areas which will be planted. The surface water runoff from the pavement of the parking areas will be disposed of via the landscaped area through the use of SuDS features.

11.6 Flood Risk Assessment

Hydrological modelling was undertaken to predict any potential impacts of the Proposed Development on the existing flooding regimes of the lands and properties located in close vicinity of the relevant watercourses. Detailed Flood risk Assessment reporting for each road section is within Appendix C11.01 to Appendix C11.03.

Note that as part of the iterative design process, any crossings or encroachments within the watercourse's floodplains were minimised such that any increase in flood levels in the upstream or downstream vicinity due to flood volume storage loss will be minimal.

Net head losses at proposed bridges are less than the OPW section 50 Guidelines specified head loss of 300 mm in all cases, and the available freeboards above the design flood levels are greater than the OPW section 50 Guidelines specified freeboard of 300 mm in all cases.

11.6.1 Section 1

Culverts were sized based on the calculations set out in the updated CIRIA Culvert, Screen and Outfall Manual (2019), CIRIA Report No. C786. Culvert S1-CUL 14 and S1-CUL 28 were sized using HEC-RAS modelling software. Refer to Table 11-31 for culvert design parameters.

The hydraulic designs of the bridge openings were carried out by building HEC-RAS hydraulic models for all relevant watercourse's channels. Table 11-46 presents the bridge design parameters and modelled freeboard and net headloss for the 1% AEP design flood conditions.

Table 11-46: Bridge Design Parameters and Estimated Freeboard/Headloss

Bridge Ref	Catchment Area (km^2)	SAAR (mm)	Design Flow (Q_{100} + 20% CCA)	Bridge Span & Length (m)	Width (m)	Freeboard (mm)	Net Head Loss (mm)
River Finn Bridge	309.96	1,995.1	606.58	Seven-span 360 m	26.5	7.14	80
Backlees River Crossing	4.98	1,372.1	20.77	Single span 45 m	26	3.75	200
Cloghroe River Crossing	10.75	1,503.1	51.08	Single span 18 m	26	0.35	60

11.6.2 Section 2

All culverts were sized based on the calculations set out in the updated CIRIA Culvert, Screen and Outfall Manual (2019), CIRIA Report No. C786. Refer to Table 11-36 for culvert design parameters.

The hydraulic designs of the bridge openings were carried out by building HEC-RAS hydraulic models for all relevant watercourse's channels presents the bridge design parameters and modelled freeboard and net headloss for the 1% AEP design flood conditions. Table 11-47 outlines the bridge design parameters and estimated freeboard / headloss within Section 2.

Table 11-47: Bridge Design Parameters and Estimated Freeboard/ Headloss

Bridge Ref	Catchment Area (km^2)	SAAR (mm)	Design Flow (Q_{100} + 20% CCA)	Bridge Span & Length (m)	Width (m)	Freeboard (mm)	Net Head Loss (mm)
River Swilly Bridge	96.76	1,568.43	181.09	Three-Span 234 m	28.25	3.70	0
Isle Burn Footbridge	54.57	1,110.34	39.61	Single Span 40 m	4.5	2.24	0

11.6.3 Section 3

Culverts were sized based on the calculations set out in the updated CIRIA Culvert, Screen and Outfall Manual (2019), CIRIA Report No. C786. Culvert S1-CUL 14 was sized using HEC-RAS modelling software. A summary of the resulting calculation outputs and proposed culvert details within Section 3 are given in Table 11-41.

The hydraulic designs of the bridge openings were carried out by building HEC-RAS hydraulic models for all relevant watercourse channels. Table 11-48 presents the bridge design parameters and modelled freeboard and net head loss for the 1% AEP design flood conditions.

Table 11-48: Bridge Design Parameters and Estimated Freeboard/ Headloss

Bridge Ref	Catchment Area (km^2)	SAAR (mm)	Design Flow (Q_{100} + 20% CCA)	Bridge Span & Length (m)	Width (m)	Freeboard (mm)
River Finn Bridge	250	1,010	650	284 (Eight span)	25 Deck width	300 mm Minimum
River Deele	128.76	1,361	293.68	60 m Central Span (Abutments) 24 Backspans (Abutments)	52 Deck Width	300 mm Minimum
Swilly Burn	24.33	1,066	33.34	23.5 Abutments	50 Deck Width	300 mm Minimum

11.7 FRA - Field Assessment

Site visits were conducted throughout the design process by members of the environment and design teams to evaluate on-site flooding conditions and to review flood mechanisms in affected areas. It was found that recorded evidence of flooding as available via the OPW online resources (www.floodinfo.ie) correlated with what was observed during heavy rainfall periods. As part of the landowner consultation process, LLOs have been on site since 2019. These have been in contact with the Drainage design team and have been relaying all evidence of surface water flooding either observed or reported to them by landowners.

11.7.1 Section 1

The LLOs gained information on how the flood mechanism in the vicinity of the proposed tie-in with the existing N15 road at Stranorlar operates. The Proposed Development at that location is on the low-lying floodplains of the River Finn and its tributary, Mullaghagarry River. River Finn and Mullaghagarry flood every winter (approximately four to five times). The worst flooding occurred in the area in December 2015. The anecdotal record suggests that flood level at the existing N15 bridge crossing rose to a level of 14.95 m ordnance datum (OD) on 5 December 2015, which caused flooding of a section of the adjacent N15 road and the downstream disused railway embankment.

11.7.2 Section 2

The LLOs gained information on how the flood mechanism along the river Swilly at Letterkenny operates. The Proposed Development at Letterkenny crosses the river Swilly and also passes through its low-lying floodplains. Flooding at this location results from the joint occurrences of both fluvial and tidal events.

11.7.3 Section 3

The LLOs gained information on how the flood mechanism along the River Deele operates. The existing river is protected by flood embankments designed to allow drainage of water from the surrounding fields into the river during low water conditions. When river levels rise, non-return (flap) valves within the embankments effectively prevent backflow, thereby protecting the fields from flooding. These mechanisms were systematically observed and documented by LLOs, whose detailed reports were promptly communicated to the drainage design team for analysis. Although localized flooding was recorded in the vicinity of the River Finn and the Deele from 2019 onwards, the flood levels consistently remained below the 1% AEP threshold established by the CFRAM flood risk maps.

11.8 Assessment of Effects

11.8.1 Relevant Characteristics of the Proposed Development

A detailed description of the project including its design and construction methodology is presented in Chapter 4: Project Description. Aspects of the Proposed Development are provided in the following sections at each watercourse to underpin the examination of potential direct, indirect and cumulative effects on hydrological attributes during both the construction and operation phases.

11.8.2 Do Nothing Scenario

In the absence of the Proposed Development (i.e. the “do nothing” scenario), there will be no temporary / short-term construction related negative impacts on the hydrological attributes, primarily related to potential degradation of water quality. However, the water catchments in question (01 Foyle and 39 Lough Swilly) will be subject to continued water quality pressures linked to existing land use management practice as currently experienced, including run-off associated with agriculture, forestry and urban pressures. It is noted that such existing pressures will be likely to gradually reduce owing to the overarching objective of the WFD which requires improvement of all surface waters to at least good status by 2027 through ‘programmes of measures’ to be implemented through river basin management planning.

However, unattenuated (and consequently untreated) road run-off pollution from existing major road surfaces (N15, N13, N14) that currently have inferior, and predominantly no drainage treatment, will continue to enter receiving watercourses. Such ongoing sources of potential operational phase run-off may worsen as traffic volumes are predicted to increase into the future (refer to Chapter 6: Traffic and Transport Assessment) because pollutant concentrations in highway run-off are linked to traffic volume as average annual daily traffic (AADT) (CEDR, 2018 a, b). This is of particular significance in areas where severely congested traffic occurs regularly across the existing River Finn bridge in Ballybofey (Section 1) and N56 Port Bridge over the River Swilly in Letterkenny (Section 2), which can give rise to elevated concentrations of typical road run-off pollutants linked to idling and stop-start traffic (Huber et al., 2016). The Proposed Development incorporates

modern drainage design features (hybrid wetland attenuation ponds, swales, hydrocarbon interceptors) which will likely contribute to long-term positive effects on water quality into future, i.e., in line with WFD objectives, and therefore contribute to positive effects on aquatic habitats (compared to the do-nothing scenario) that would not otherwise be achieved.

11.8.3 Construction Phase Impacts

11.8.3.1 Impact on Water Quality

None of the watercourses likely to be impacted by the Proposed Development works (sections 1,2, and 3) are currently being used as raw water sources for drinking waters. However, water quality degradation could cause negative impacts on aquatic habitats unless appropriate mitigation measures are implemented during the construction phase.

Mobilised suspended solids are generally the prime concern during the construction phase of a large road project, but spillage of fuels, lubricants, hydraulic fluids and cement from construction plants may lead to incidents if there are inadequate pollution control measures. Other risks include:

- Pollution from pumped discharges, for example, dewatering of cofferdams or temporary diversions.
- Pollution linked to dust emissions.
- Pollution owing to vandalism of stores or plants.

Sources of suspended solids include uncontrolled run-off from (not exhaustively) site enabling works (ground investigations and archaeological testing), earthworks, haulage routes, material extraction and deposition areas and material stockpiles. Dewatering activities, in-stream works and enabling works may also generate sediment-laden run-off. Sources of cementitious particles include the pouring of concrete, run-off from freshly poured concrete and washout of concrete delivery trucks and equipment. Sources of hydrocarbons include run-off or leakage from machinery, accidental spillages during refuelling or storage of petroleum-based products. Both natural and manmade drainage networks provide direct pathways from the source of pollutants at construction areas to the surrounding receptors (watercourses).

It is noted that a comprehensive range of measures has been incorporated into the design and proposed construction methodology to control the sources and pathways of pollutant transport to watercourses during the construction phase of the Proposed Scheme; refer to Chapter 4: Project Description.

The construction phase impacts on water quality primarily relates to the watercourse's ability to support aquatic organisms. Water quality effects on aquatic receptors have been assessed in Chapter 9B: Biodiversity – Aquatic, refer to Section 9B.5.3. In the absence of site-specific mitigation around sediment (and other pollutant) loss controls there is potential for temporary to short term **significant negative** effects on fish bearing channels (IEF watercourses) identified in Chapter 9B of this EIAR.

11.8.3.2 Impact on Flood Risk

Flooding risks to the lands and properties during the construction stage of new roads could result from the following construction stage activities:

- Temporary paved surfaces or roofed areas of site compounds may increase the rate of runoff.
- 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.
- Inadequate sizing of temporary flow diversion channels could cause flooding to the adjacent lands and properties.

The following are noted within the design:

- Interceptor ditches will be constructed before the commencement of earthwork to intercept any overland flow from the natural catchments adjacent to the Proposed Development works and prevent ponding of

water in the working area. Cross-drains will be provided to convey flow from the interceptor ditches beneath the Proposed Development to the outfall/discharge locations where required. The ditches have been sized to cater for a 1 in 75-year return period as per DN-DNG-03064 (HD 106) Drainage of Runoff from Natural Catchments (TII, 2015). Runoff from temporary working areas will be attenuated to allow suspended solids settlement before discharging into the receiving watercourses.

- There are no in-stream construction works at the proposed two River Finn bridges (Sections 1 and 3), River Swilly Bridge (Section 2), Isle Burn Active Travel Footbridge (Section 2), Swilly Burn Bridge or River Deele Bridge (Section 3).
- The proposed river diversion and bridge at Cloghroe River CH0+300(Mainline 1.3) requires instream works to create a permanent diversion beneath the proposed new bridge construction to connect the new bridge/diversion channel to the existing river channel.
- All bridges, culverts and permanent diversion channels have been designed in accordance with OPW Section 50 and OPW Section 9 in terms of flood conveyance.
- Construction compounds, extraction and deposition areas are not located within flood prone areas. Additional surface runoff likely to be generated from the construction compounds will be attenuated and discharged at greenfield runoff rate into the adjacent watercourses.

11.8.3.2.1 Section 1

Potential construction stage impacts on flood risk are summarised in Table 11-49, Predicted impacts associated with the road cutting, construction compounds & material depositions, and material extractions activities are also assessed and presented in Table 11-50, Table 11-51 and Table 11-52, respectively.

River Finn and Tributaries Culverts

With reference to proposed culverts S1-CUL-01 to S1-CUL-28. The culverts S1-CUL-01, S1-CUL-14, and S1-CUL-28 are identified to be susceptible to flooding in the construction phase. These 3 no. culverts are to be constructed online, meaning a temporary diversion or pump-over will be required parallel to the line of the culvert so that they can be constructed in the dry. It is noted that these 3 no. culverts are on fish bearing watercourses (Refer to Appendix 9B.04) and are subject to instream works timing restrictions that limit construction to between 1st May and September 30th of any year. This inherently reduces flood risk owing to the reduced probability of flooding in the allowable work window. The road embankment through this region will be constructed of Starter 6A Material which will allow continuity of flow across the flood plain.

River Finn Bridge

At Chainage CH2+400, the mainline crosses the River Finn. There are no OPW-maintained arterial drainage channels at this location. The proposed bridge has seven-spans: 43 m, 55 m, 85 m, 55 m, 43 m, 39.5 m and 39.5 m giving a total length of 360 m. The 85 m main span will cross the full width of the River Finn plus the existing R252 road. The Southern Abutment and Piers 1 and 2 are located on the south side of the river and are outside the 0.1%AEP flood extent with low probability of construction phase flood impact. The southern bridge pier (Pier 2) is set back from the channel by virtue of being immediately south of the R252 road where temporary construction works occur at nearest just over 5m from the SAC boundary and approximately 8 m from the River Finn wetted channel.

On the northern side of the river, Piers 3, 4, 5 and 6 continue across the floodplain meeting the Northern Abutment where the road embankment commences. The northern embankment / abutment is, at nearest, 85m from the SAC boundary.

On the northern bank, the closest pier to the river (Pier 3) is set c.5m back from the SAC boundary and approximately 15 m in total from the River Finn wetted channel. However, the temporary construction works area is directly contiguous with the SAC boundary i.e., the works area will meet the SAC boundary but is outside the SAC (10 m back from the Finn wetted channel).

No instream works will be undertaken, thereby avoiding direct impact on the river channel and aquatic habitats. The construction approach set out in Chapter 4: Project Description includes measures to prevent sediment runoff and protect water quality. Refer Chapter 4 for more details.

Backlees River Bridge

At Chainage CH4150, the mainline crosses the Backlees River. There are no OPW-maintained arterial drainage channels at this location. The bridge abutments are be set back 5 m from the riverbank crest to preserve a natural riverbank and a minimum 2.5 m wide no working zone will be demarcated behind the banks to minimize environmental disturbance during construction. No instream works will be undertaken, thereby avoiding direct impact on the river channel and aquatic habitats. In the absence of robust water quality protection measures and in combination with installation of CUL-S1.14 upstream at this location, there is potential for indirect and direct **significant** effects on water quality with effects on aquatic receptors of the Backlees Stream. Refer to Chapter 9B: Biodiversity – Aquatic, Section 9B.5.3.2.

Cloghroe River Bridge

The mainline Section 1 road crosses the Cloghroe river at CH0300 on the N13 Tie-in Road. There are no OPW-maintained arterial drainage channels at this location. The Cloghroe River Bridge requires instream works during construction for a permanent river realignment to take the existing channel beneath the new bridge. Bridge abutments will be a minimum of 5 m from the bank of the newly diverted channel. Refer to Chapter 9B: Biodiversity – Aquatic, Section 9B.5.3.2 for a description of impacts and effects on water quality and aquatic receptors and the proposed construction sequencing in Section 9B.6.1.2. In the absence of robust water quality protection measures there is potential for indirect and direct **significant** effects on water quality with effects on aquatic receptors of the Cloghroe River.

Construction phase flood risk is inherently limited because this is a salmonid channel and instream works can only occur between 1st May and September 30th of any year, which reduces the probability of large floods in the allowable work window. In any event, the channel is deepened at this location with increased capacity and the realigned channel will be constructed offline with existing banks in place until such time as the new channel is completed.

Table 11-49: Section 1 Construction Phase Impacts on Flood Risk

EPA Watercourse Name	Segment	Hydrological Importance Rating (TII Guidelines)	Proposed Development	Historical/ Predicted Flood Risk	Level of Impact (TII Guidelines)	Significance of Impact (EPA, 2022)
Burn Daurnett	01_1815	**High:** River is salmon spawning tributary of River Finn. No residential or commercial properties located in the vicinity and this stream segment. Water quality Q3-4 (EPA 2022 data)	The proposed tie-in with the existing N15 encroaches the 1%AEP flood extent of this stream segment at Ch. 0+300. Attenuated road runoff outfalls into this stream segment at Ch. 0+300 (outfall no.14).	River segment liable to 1% AEP flooding	Temporary, Small Adverse	Moderate/slight
Un-named (Trib of Burn Daurnett)	01_1826	**Medium:** no residential or commercial properties are in the vicinity. Stream segment is a small trout stream (high local importance).	Culvert S1-CUL01 to be constructed on this watercourse	River segment is liable to 1% AEP flooding	Temporary, Small Adverse	Slight
Cappry	01_1816	**Low:** no residential or commercial properties are in the vicinity. Stream segment is of low ecological importance.	Culverts CUL08, CUL09, CUL10 & CUL11 to be constructed on this watercourse	River Segment is not liable to flooding	Temporary, Negligible	Imperceptible
Finn [Donegal]	01_810 01_7147	**Extremely High:** River Finn bridge upstream of urban Ballybofey/ Stranorlar. Designated SAC and Salmonid Water. Water quality Q4-5 (EPA 2022 data)	A 7-span 360 m long bridge structure is proposed over the River Finn (mainline 1.2 02+435) with no piers within the main river channel.	River segment is liable to 1% AEP flooding	Temporary, Negligible	Imperceptible
Aghasheil	01_553	**Medium** a number of residential properties are in the eastern vicinity of this stream segment. Low aquatic ecological value.	Culvert S1-MWC13 to be constructed on this watercourse	River Segment is not liable to flooding	Temporary, Negligible	Imperceptible
Drumboe Lower	01_589	**Extremely High:** No residential or commercial properties are in the vicinity and this stream segment, but lower reaches of the stream are within River Finn SAC and support juvenile salmonids.	Culverts S1-CUL12 & S1-CUL13 to be constructed on this watercourse	River Segment is not liable to flooding	Temporary, Negligible	Imperceptible

EPA Watercourse Name	Segment	Hydrological Importance Rating (TII Guidelines)	Proposed Development	Historical/ Predicted Flood Risk	Level of Impact (TII Guidelines)	Significance of Impact (EPA, 2022)
Greenhills	01_70	**Medium:** A number of commercial & residential properties are in its vicinity. Low quality, largely ephemeral drain with low ecological significance.	Culverts S1-CUL16 & S1-CUL17) to be culverted on this watercourse	River Segment is not liable to flooding	Temporary, Negligible	Imperceptible
Backlees	01_186	**Medium:** A number of commercial & residential properties are in its upstream/downstream vicinity. Small trout stream. Water quality Q3 (project specific data 2024)	This segment of the Backlees river channel is proposed to be culverted under an access road (S1-CUL14) and a 52 m single span bridge has been proposed at mainline CH4+150.	River Segment is identified to be liable to minor flooding	Temporary, Small Adverse	Slight
Tircallan	01_3 & 01_04	**Medium:** A small number of residential properties are in its upstream/downstream vicinity. Small trout spawning/nursery stream. Water Quality Q3-4 (project specific field data)	The stream segment 01_04 is proposed to be culverted at two locations on the proposed northern link road (S1-CUL21 & S1-CUL22).	River Segments is not identified to be liable to flooding	Temporary, Small Adverse	Slight
Mullaghagarry	01_69	**Medium:** No residential or commercial properties in the vicinity and these stream segments. Small trout spawning / nursery tributary system of River Finn. Water quality Q3-4 / Q4 (project specific field data).	It is proposed to divert the 01_67 stream segment north of an access road and join with the stream segment 01_69 and the combined flow passes through a Culvert under the access road (S1-CUL25), which further downstream discharges into the stream segment 01_68.	River Segments is not identified to be liable to flooding	Temporary Negligible Impact	Imperceptible
Castlebane 01	01_67					
Mullaghagarry	01_68					
Treanamullin	01_66	**Low:** No residential or commercial properties are located in the vicinity. Ephemeral drain of low ecological quality.	This stream segment is proposed to be culverted under the northern link road at CH3+175 (S1-CUL27).	River Segments is not identified to be liable to flooding	Temporary Negligible Impact	Imperceptible
Mullaghagarry	01_776	**Medium:** No residential or commercial properties are located in the vicinity and this stream segment. Small trout spawning / nursery tributary of River	The N15 tie in junction will be located within the 1%AEP flood extent and the Mullaghgarry River channel will be culverted	River segment is liable to 1% AEP flooding	Temporary Small Adverse Impact	Slight

EPA Watercourse Name	Segment	Hydrological Importance Rating (TII Guidelines)	Proposed Development	Historical/ Predicted Flood Risk	Level of Impact (TII Guidelines)	Significance of Impact (EPA, 2022)
		Finn. Water quality Q3-4 / Q4 (project specific field data).	under this tie in road at CH0+155) (S1-CUL28).			
Lisnaree	01_928	**Medium:** A number of residential properties are located in its downstream vicinity. Ephemeral, channelised drain of low ecological quality.	Culverts S1-CUL30 & S1-CUL33 to be constructed on this watercourse	River Segments is not identified to be liable to flooding	Temporary Small Adverse Impact	Slight
Magheracorran	01_1024	**Medium:** A number of residential properties are in its upstream/downstream vicinity. Small trout spawning / nursery tributary of Cloghroe River (Deele). Water quality Q3-4 /Q4 (project specific field data).	The subject stream segment is proposed to be culverted under a local link road (S1-CUL34) and under the mainline carriageway at CH8+500 (S1-CUL36).	River Segments is not identified to be liable to flooding	Temporary Small Adverse Impact	Slight
Magheracorran	01_1530	**Medium:** A number of residential properties are in its upstream/downstream vicinity. Small trout spawning / nursery tributary of Cloghroe River (Deele). Water quality Q3-4 /Q4 (project specific field data).	Culvert S1-CUL31 to be constructed on this watercourse	River Segments is not identified to be liable to flooding	Temporary Small Adverse Impact	Slight
Cloghroe 010	01_1796	**Medium:** A number of residential properties are in upstream/downstream vicinity. Salmonid spawning / nursery tributary of River Deele. Water quality Q3 (project specific field data).	18 m clear span bridge proposed over the Cloghroe river channel (CH0+300). Permanent channel diversion to accommodate new bridge.	River segment is liable to 1% AEP flooding	Temporary Small Adverse Impact	Slight

Table 11-50: Section 1 Construction Phase Flood Impacts Road Cutting Areas

Cutting Location	Receiving Watercourse (EPA Name)	Receiving Watercourse (EPA Code)	Hydrological Importance Rating (TII Guidelines)	Impact (Flooding)
Mainline Chainage 0+150 to 1+000	Burn Daurnett	01_1815	**High:** River is salmon spawning tributary of River Finn. No residential or commercial properties located in the vicinity and this stream segment. Water quality Q3-4 (EPA 2022 data)	Temporary, Imperceptible Impact
Mainline Chainage 1+100 to 1+600	Finn	01_810	**Extremely High**: River Finn bridge upstream of urban Ballybofey/ Stranorlar. Designated SAC and Salmonid Water. Water quality Q4-5 (EPA 2022 data)	Temporary, Imperceptible Impact
Mainline Chainage 3+300 to 4+000	Drumboe	01_589	**Extremely High**: No residential or commercial properties are in the vicinity and this stream segment, but lower reaches of the stream are within River Finn SAC and support juvenile salmonids.	Temporary, Imperceptible Impact
Mainline Chainage 4+950 to 6+000	Greenhills_01	01_70	**Medium**: A number of commercial & residential properties are in its vicinity. Low quality, largely ephemeral drain with low ecological significance.	Temporary, Imperceptible Impact
Mainline Chainage 6+550 to 7+450	Magheracorran	01_1530	**Medium**: A number of residential properties are in its upstream/downstream vicinity. Small trout spawning / nursery tributary of Cloghroe River (Deele). Water quality Q3-4 /Q4 (project specific field data).	Temporary, Imperceptible Impact
LX-1007-2 Northern Link Road Ch. 0+000 to 0+300 m.	Tircallan	01_3 & 01_04	**Medium**: A small number of residential properties are in its upstream/downstream vicinity. Small trout spawning/nursery stream. Water Quality Q3-4 (project specific field data).	Temporary, Imperceptible Impact
LX-1007-1 Northern Link Road Ch. 2+250 to 2+900 m.	Mullaghagarry	01_776	**Medium**: No residential or commercial properties are located in the vicinity and this stream segment. Small trout spawning / nursery tributary of River Finn. Water quality Q3-4 / Q4 (project specific field data).	Temporary, Imperceptible Impact
L-7084 Ch. 0+300 to 0+500	Magheracorran	01_1530	**Medium**: A number of residential properties are in its upstream/downstream vicinity. Small trout spawning / nursery tributary of Cloghroe River (Deele). Water quality Q3-4 /Q4 (project specific field data).	Temporary, Imperceptible Impact

Table 11-51: Section 1 Construction Phase Flood Impacts of Material Deposition and Construction Compounds

Site Reference/Location	Description	Nearest Watercourse	Hydrological Importance Rating (TII Guidelines)	Flooding Potential (Y/N)	Impacts (Flooding)
Mainline Chainage Ch. 1+500 to 1+750 m (at Cappry) (1.8 ha)	Temporary site for Contractor offices/ plant. Including material and bulk fuel storage.	Finn 01_810	**Extremely High**: River Finn bridge upstream of urban Ballybofey/ Stranorlar. Designated SAC and Salmonid Water. Water quality Q4-5 (EPA 2022 data)	N	Imperceptible
N15 Connector Ch. 2+500 to 2+850 m - (at Trenamullin) (1.95 ha)	Temporary site for Contractor offices/ plant. Including material and bulk fuel storage.	Mullaghagarry 01_776	**Medium**: No residential or commercial properties are located in the vicinity and this stream segment. Small trout spawning / nursery tributary of River Finn. Water quality Q3-4 / Q4 (project specific field data).	N	Imperceptible
S1.D02/L-2794 Connector Road Ch. 0+150 to 0+200 - 0.18 ha	Soil Disposal Area	Cappry 01_1816	**Low:** no residential or commercial properties are in the vicinity. Stream segment is of low ecological importance.	N	Imperceptible
S1.D03/Mainline Ch. 1+800 to 1+850 - 1.10 ha	Soil Disposal Area	Aghasheil 01_553	**Medium**: a number of residential properties are in the eastern vicinity of this stream segment. Low aquatic ecological value.	N	Imperceptible
S1.D04/Mainline Ch. 2+000 to 2+100 - 0.26 ha	Soil Disposal Area	Aghasheil 01_553	**Medium**: a number of residential properties are in the eastern vicinity of this stream segment. Low aquatic ecological value.	N	Imperceptible
S1.D05/Mainline Ch. 3+950 to 4+050 - 0.14 ha	Soil Disposal Area	Backlees 01_186	**Medium**: A number of commercial & residential properties are in its upstream/downstream vicinity. Small trout stream. Water quality Q3 (project specific data 2024)	N	Imperceptible
S1.D06/L-2734 Tie-in Ch. 0+050 to 0+150 - 0.51 ha	Soil Disposal Area	Backlees 01_186	**Medium**: A number of commercial & residential properties are in its upstream/downstream vicinity. Small trout stream. Water quality Q3 (project specific data 2024)	N	Imperceptible
S1.D07/L-2734 Tie-in Ch. 0+200 to 0+250 - 0.17 ha	Soil Disposal Area	Backlees 01_186	**Medium**: A number of commercial & residential properties are in its upstream/downstream vicinity. Small trout stream. Water quality Q3 (project specific data 2024)	N	Imperceptible

Site Reference/Location	Description	Nearest Watercourse	Hydrological Importance Rating (TII Guidelines)	Flooding Potential (Y/N)	Impacts (Flooding)
S1.D08/L-2724 Connector Road Ch. 0+150 to 0+250 - 0.22 ha	Soil Disposal Area	Greenhills 01 01_70	**Medium**: A number of commercial & residential properties are in its vicinity. Low quality, largely ephemeral drain with low ecological significance.	N	Imperceptible
S1.D09/Mainline Ch. 8+100 to 8+200 - 0.58 ha	Soil Disposal Area	Lisnaree 01_928	**Medium**: A number of residential properties are located in its downstream vicinity. Ephemeral, channelised drain of low ecological quality.	N	Imperceptible
S1.D10/Mainline Ch. 8+350 to 8+600 - 0.56 ha	Soil Disposal Area	Magheracorran 01_1024	**Medium**: A number of residential properties are in its upstream/downstream vicinity. Small trout spawning / nursery tributary of Cloghroe River (Deele). Water quality Q3-4 /Q4 (project specific field data).	N	Imperceptible
S1.D11/LX-1011 Connector Rd Ch. 0+050 to 0+250 - 0.34 ha	Soil Disposal Area	Lisnaree 01_928	**Medium**: A number of residential properties are located in its downstream vicinity. Ephemeral, channelised drain of low ecological quality.	N	Imperceptible
S1.D12/L-6674 Connector Rd Ch. 0+150 to 0+250 - 0.14 ha	Soil Disposal Area	Magheracorran 01_1024	**Medium**: A number of residential properties are in its upstream/downstream vicinity. Small trout spawning / nursery tributary of Cloghroe River (Deele). Water quality Q3-4 /Q4 (project specific field data).	N	Imperceptible
S1.D13/LX-1004 Ch. 0+000 to 0+100 - 0.28 ha	Soil Disposal Area	Unnamed drainTircallan_01_3	**Medium**: A small number of residential properties are in its upstream/downstream vicinity. Small trout spawning/nursery stream. Water Quality Q3-4 (project specific field data)	N	Imperceptible
S1.D14/Primary Connector Road Ch. 1+350 to 1+550 - 2.26 ha	Soil Disposal Area	Mullaghagarry 01_69	**Medium**: No residential or commercial properties in the vicinity and these stream segments. Small trout spawning / nursery tributary system of River Finn. Water quality Q3-4 / Q4 (project specific field	Y - Slightly encroaches the Mullaghagarry River floodplains. No flooding risk expected to any property	Imperceptible

Site Reference/Location	Description	Nearest Watercourse	Hydrological Importance Rating (TII Guidelines)	Flooding Potential (Y/N)	Impacts (Flooding)
S1.D16/L-7084 Connector Road Ch. 0+850 to 0+950 - 0.10 haS1.D15/Primary Connector Road Ch. 1+750 to 1+950 - 1.18 ha	Soil Disposal AreaSoil Disposal Area	Magheracorran_01_1024-Mullaghagarry 01_69	**Medium**: A number of residential properties are in its upstream/downstream vicinity. Small trout spawning / nursery tributary of Cloghroe River (Deele). Water quality Q3-4 /Q4 (project specific field data).	NY - Slightly encroaches the Mullaghagarry River floodplains. No flooding risk expected to any property	Imperceptible
S1.D16/L-7084 Connector Road Ch. 0+850 to 0+950 - 0.10 ha	Soil Disposal Area	-		N	Imperceptible

Table 11-52: Section 1 Potential Impacts Associated with the Material Extraction Areas

Site Reference/Location	Estimated Material Volume (m^3)	Nearest Watercourse	Hydrological Importance Rating (TII Guidelines)	Flooding Potential (Y/N)	Impacts (Flooding)
S1.ME01 / Mainline Chainage Ch. 1+600 m	104,000	Finn 01_810	**Extremely High**: River Finn bridge upstream of urban Ballybofey/ Stranorlar. Designated SAC and Salmonid Water. Water quality Q4-5 (EPA 2022 data)	N	Temporary Imperceptible

11.8.3.2.2 Section 2

Potential construction phase impacts on flood risk are summarised in Table 11-53, Predicted impacts associated with the road cutting, construction compounds & material depositions, and material extractions activities are also assessed and presented in Table 11-54, Table 11-55 & Table 11-56, respectively.

River Swilly and Tributaries Culverts

The culverts S2-CUL-13, S2-CUL-16, S2-CUL-17, S2-CUL-19, S2-CUL-20 and S2-CUL-27 are susceptible to flooding. The road embankment through this region will be constructed of Starter 6A Material which will allow continuity of flow across the flood plain. All these culverts are to be constructed online, meaning a temporary diversion will be required parallel to the line of the culvert so that they can be constructed in the dry. The Contractors works will take account of the flooding threat in this region, and this area will not be used for the storage of excavated material, plant or construction materials.

Isle Burn Active Travel Footbridge
At Chainage CH3+400, the mainline crosses the Leslie Hill Stream. Details of the construction sequence and standard water quality protection measures during the footbridge construction are set out in Section 4.13.10 in Chapter 4: Project Description. The single span steel bridging structure will be craned into position following construction of the abutments. Temporary fencing at 5 m set-back from the river channel will demarcate the limit of allowable working, providing a 'no-go' exclusion zone for the construction period. Access tracks and haul routes will approach from either bank for the installation of abutments. Existing flood protection embankments, run along each side of the main river. Flows from the adjacent farmlands enter OPW maintained arterial drainage channels and the embankment toe-drain on the landward side of the embankment. These channels are connected with the Leslie hill stream via non return valves which control outfall. The proposed footbridge is only 4.5 m in width and clear spans the watercourse. It has no impact on the OPW embankment toe drain as there is a break in the toe-drain at the existing N13 culvert structure. The bridge abutments are setback 5 m from the riverbank crest to provide a natural bank and enable a 3 m wide 'no working zone' behind the riverbank crests. No instream works are required.

River Swilly Bridge

At Chainage CH385-630 on the main N56/M13 alignment arm crosses the estuarine River Swilly. Flood protection embankments, run along each side of the main river. Flows from the adjacent lands enter OPW maintained arterial drainage channels which run into the toe-drains on the landward side of the embankments. These channels are connected with the main River Swilly via non return valves which control outfall. The bridge has been designed to clear span the Lough Swilly SAC River channel with no temporary or permanent works footprint within in the SAC and also spans the OPW embankment toe-drain. No instream works are required.

The Eastern Pier of the bridge (Milk Isle side) is set behind the combined raised flood embankment and backing toe-drain at a distance of > 50m from the tidal River Swilly wetted channel. This is distance of c.3 m set back from the SAC boundary. The Eastern Abutment is a further 63 m inland from the pier. The entire eastern side of the channel is protected from the 10%AEP coastal flood events by the height of the existing OPW Swilly Embankments. There is a low probability of construction phase flood impact on that side of the river.

The Western Pier (Ballyraine side) is located approximately 5 m from the Lough Swilly SAC boundary and a total of 15 m from the Swilly wetted channel on gently sloping, rough grassland. The Western Abutment will be a further 63 m inland from the pier. The Western Abutment is outside the flood zone with low probability of construction phase flood impact. The pier on this side of the river lies within both the 1% AEP fluvial flood zone and the 0.5% AEP coastal flood zone. In addition, much of the proposed Bonagee Junction and the Swilly River Bridge approach road are located within the 1% AEP floodplains of the River Swilly and the Corravaddy River, as well as the 0.5% AEP coastal flood zone. As a result, the overall impact on flood risk is considered significant.

Table 11-53: Section 2 Construction Phase Impacts on Flood Risk

EPA River Name	Watercourse Segment Code	Hydrological Importance Rating (TII Guidelines)	Proposed Development	Historical / Predicted Flood Risk	Magnitude of Impact (TII Guidelines)	Significance of Effect (EPA, 2022
Un-named (at Drumany)	39_1545	**Medium:** A number of residential properties located in the western vicinity of this stream segment (at road Ch. 2+100). Low ecological value with no fisheries significance and poor water quality.	Culvert S2-CUL13 to be constructed on this watercourse	River segment is liable to 1% AEP flooding	Temporary, Small Adverse	Slight
Un-named (at Dromore Lower)	39_1544	**Medium:** A number of residential and commercial properties are located in the western vicinity of Dromore junction. Low ecological value with no fisheries significance and poor water quality.	Culverts S2-CUL16, S2-CUL17 and S2-CUL19 to be constructed on this watercourse	River segment is liable to 1% AEP flooding	Temporary, Small Adverse	Slight
Bunnagee	39_2934 & 39_1288	**Medium:** A commercial property located in the eastern vicinity of this stream segment. Low-quality drain.	Culvert S2-CUL20 to be constructed on this watercourse	River segment is liable to 1% AEP flooding	Temporary, Small Adverse	Slight
Un-named (at Dromore)	39_1021 & 39_225	**Medium,** a number of residential and commercial properties are located in the upstream vicinity of a proposed culvert crossing (S2-CUL20). Low ecological value with no fisheries significance and poor water quality.	Culvert S2-CUL28 to be constructed on this watercourse	River Segment is not identified to be liable to flooding	Temporary, Small Adverse	Slight
Dromore 39	39_2954	**Medium:** No residential or commercial properties are located in the vicinity. Low quality with no fisheries significance and poor water quality in the crossing reach.	Culvert S2-CUL27 to be constructed on this watercourse.	River segment is liable to 1% AEP flooding	Temporary, Small Adverse	Slight
Maghera_More 39	39_413	**Low:** No commercial & residential properties are located in its upstream/downstream vicinity.	Culvert S2-CUL34 to be culverted on this watercourse.	River Segment is not identified to be liable to flooding	Temporary, Negligible	Imperceptible
Trimragh	39_412	**Low:** A small number of residential properties are located in the upstream vicinity of its crossing with the proposed mainline carriageway. Low quality, ephemeral, with no fisheries significance and poor water quality in the crossing reach.	Culvert S2-CUL33 to be culverted on this watercourse.	River Segment is not identified to be liable to flooding	Temporary, Negligible	Imperceptible

EPA River Name	Watercourse Segment Code	Hydrological Importance Rating (TII Guidelines)	Proposed Development	Historical / Predicted Flood Risk	Magnitude of Impact (TII Guidelines)	Significance of Effect (EPA, 2022
Leslie Hill (Stream)	39_741	**Extremely High:** Tidal reach of 'Isle Burn' flowing to Swilly Estuary. At boundary of Lough Swilly SAC (002287)	The mainline carriageway and Isle Burn footbridge cross this stream at Ch. 3+400.	The proposed N13 road encroaches the 1% AEP flood extents of this stream (between Ch.3+350 and Ch.3+450.	Temporary, negligible	Imperceptible
Farsetmore	39_2476	**Medium:** A number of residential properties in the upstream vicinity of Culvert S2-CUL30. Potential trout stream with 'slightly polluted' water quality (Q3-4).	The mainline carriageway crosses this stream at Ch.1+200. This stream also passes under the Trimnagh Interchange through a number of culverts (S2-CUL29, 30, 31 & 32).	The proposed link road north of the Trimnagh Interchange encroaches to the low-lying floodplain of the River Swilly and Farsetmore stream 1%AEP flood extents (CFRAM Study).	Temporary, Small Adverse	Slight
Coaghmill	39_2151	**Low:** No commercial & residential properties are located in upstream / downstream the vicinity. Low quality, ephemeral, with no fisheries significance and poor water quality in the crossing reach.	The proposed L-5784 realignment crosses the Coaghmill stream at Ch. 0+160 and also a stretch of this road encroaches its floodplain in the upstream vicinity of the proposed culvert crossing (S2-CUL11).	River Segment is not identified to be liable to flooding	Temporary, Negligible	Imperceptible
Swilly 39 (& Corravaddy Burn)	39_2718 & 39_2724	**Extremely High**: A number of residential & commercial properties are in its upstream/downstream vicinity. Crossing of River Swilly Estuary Transitional waterbody within the Lough Swilly SAC (002287).	The proposed Letterkenny link road crosses the River Swilly at CH0+520.	Much of the proposed Bonagee Junction and the Swilly River Bridge approach road are located within the 1%AEP floodplains of River Swilly and Corravaddy River and 0.5% AEP coastal flood zones.	Temporary Small Adverse Impact	Significant

Table 11-54: Section 2 Construction Phase Flood Impacts Road Cutting Areas

Cutting Location	Receiving Watercourse (EPA Name)	Receiving Watercourse (EPA Code)	Hydrological Importance Rating (TII Guidelines)	Impacts (Flooding)
Mainline Chainage S2.2 0+250 to 1+250	Coagmil	39_2151	**Low**: No commercial & residential properties are located in upstream / downstream the vicinity. Low quality, ephemeral, with no fisheries significance and poor water quality in the crossing reach.	Temporary, Imperceptible Impact
Mainline Chainage S2.2 1+250 to 2+364	Swilly Estuary	IE_NW_220_0100	**Extremely High**: A number of residential & commercial properties are in its upstream/downstream vicinity. Crossing of River Swilly Estuary Transitional waterbody within the Lough Swilly SAC (002287).	Temporary, Imperceptible Impact
Mainline Chainage S2.6 0+220 to 0+350	Swilly Estuary	IE_NW_220_0100	**Extremely High**: A number of residential & commercial properties are in its upstream/downstream vicinity. Crossing of River Swilly Estuary Transitional waterbody within the Lough Swilly SAC (002287).	Temporary, Imperceptible Impact

Table 11-55: Section 2 Potential Impacts of Material Deposition Areas and Compounds

Site Reference/Location	Description	Nearest Watercourse	Flooding Potential (Y/N)	Impacts (Flooding)
Lurgy/Realigned L-1064 Ch. 0+250 to 0+650m - 3.6 ha	Temporary site for Contractor offices/ plant. Including material and bulk fuel storage.	Dooballagh (Burn) 39_240	N	**Imperceptible:** surface runoff will be treated before discharging into the water courses
South of proposed Bonagee Roundabout/Bonagee Link Cg.0+000 to 0+150 m - 0.5 ha	Temporary site for Contractor offices/ plant. Including material and bulk fuel storage.	BUNNAGEE 39_1288, Swilly Estuary IE_NW_220_0100	N	**Imperceptible**
S2.D01/Mainline Ch. 0+150 (0.22 ha)	Soil Disposal Area	KNOCKNAMONA 39_2961	N	**Imperceptible**
S2.D02/Mainline Ch. 0+150 (0.32 ha)	Soil Disposal Area	KNOCKNAMONA 39_2961	N	**Imperceptible**
S2.D03/Mainline Ch. 0+200 (0.92 ha)	Soil Disposal Area	BUNNAGEE 39_1288, Swilly Estuary IE_NW_220_0100	N	Imperceptible
S2.D06/L-1064 Connector Road Ch. 0+150 (0.11 ha)	Soil Disposal Area	Dooballagh (Burn) 39_240	N	**Imperceptible**
S2.D07/L-1064 Connector Road Ch. 0+200 (0.74 ha)	Soil Disposal Area	Dooballagh (Burn) 39_240	N	I**mperceptible**

Table 11-56: Section 2 Potential Impacts Associated with the Material Extraction Areas

Site Reference/ Location	Estimated Material Volume (m^3)	Nearest Watercourse	Flooding Potential (Y/N)	Hydrological Importance Rating (TII Guidelines)	Impacts (Flooding)
S2.ME01 / Mainline Ch. 0+200 m	17,000	Coaghmill 39_2151	N	**Low**: No commercial & residential properties are located in upstream / downstream the vicinity. Low quality, ephemeral, with no fisheries significance and poor water quality in the crossing reach.	Temporary Imperceptible
S2.ME02 / Side Road Ch. 0+250 m	8,000	Coaghmill 39_2151	N	**Low**: No commercial & residential properties are located in upstream / downstream the vicinity. Low quality, ephemeral, with no fisheries significance and poor water quality in the crossing reach.	Temporary Imperceptible
S2.ME03 / Mainline Ch. 0+450 m	4,000	Coaghmill 39_2151	N	**Low**: No commercial & residential properties are located in upstream / downstream the vicinity. Low quality, ephemeral, with no fisheries significance and poor water quality in the crossing reach.	Temporary Imperceptible
S2.ME04 / Mainline Ch. 0+700 m	25,000	Coaghmill 39_2151	N	**Low**: No commercial & residential properties are located in upstream / downstream the vicinity. Low quality, ephemeral, with no fisheries significance and poor water quality in the crossing reach.	Temporary Imperceptible
S2.ME05 / Mainline Ch. 0+800 m	87,000	Coaghmill 39_2151	N	**Low**: No commercial & residential properties are located in upstream / downstream the vicinity. Low quality, ephemeral, with no fisheries significance and poor water quality in the crossing reach.	Temporary Imperceptible
S2.ME06 / Mainline Ch. 1+200 m	2,000	Coaghmill 39_2151	N	**Low**: No commercial & residential properties are located in upstream / downstream the vicinity. Low quality, ephemeral, with no fisheries significance and poor water quality in the crossing reach.	Temporary Imperceptible

Site Reference/ Location	Estimated Material Volume (m^3)	Nearest Watercourse	Flooding Potential (Y/N)	Hydrological Importance Rating (TII Guidelines)	Impacts (Flooding)
S2.ME07 / Mainline Ch. 1+250 m	24,000	Unnamed Stream 39_1545	Liable to flooding (Y).	**Medium**: A number of residential properties located in the western vicinity of this stream segment (at road Ch. 2+100). Low ecological value with no fisheries significance and poor water quality.	Temporary Slight Impact
S2.ME08 / Mainline Ch. 1+900 m	18,000	Unnamed Stream 39_1545	Liable to flooding (Y).	**Medium**: A number of residential properties located in the western vicinity of this stream segment (at road Ch. 2+100). Low ecological value with no fisheries significance and poor water quality.	Temporary Slight Impact
S2.ME09 / Mainline Ch. 2+200 m	11,000	Unnamed Stream 39_1544	Liable to flooding (Y).	**Medium**: A number of residential and commercial properties are located in the western vicinity of Dromore junction. Low ecological value with no fisheries significance and poor water quality.	Temporary Slight Impact
S2.ME10 / Mainline Ch. 2+250 m	18,000	Unnamed Stream 39_1021	N	**Medium:** A number of residential and commercial properties are located in the upstream vicinity of a proposed culvert crossing (S2-CUL20). Low ecological value with no fisheries significance and poor water quality.	Temporary Imperceptible
S2.ME11 / Mainline 2.6 Ch. 0+300 m	11,000	Finn 01_810	N	**Extremely High**: River Finn bridge upstream of urban Ballybofey/ Stranorlar. Designated SAC and Salmonid Water. Water quality Q4-5 (EPA 2022 data)	Temporary Imperceptible
S2.ME12 / Side Road Ch. 0+750 m	15,000	Drumgreggan 39-1268	N	**Medium**: A number of commercial & residential properties are located in its vicinity. Low quality with no fisheries significance and poor water quality in the crossing reach.	Temporary Imperceptible
S2.ME13 / Side Road Ch. 1+200 m	2,000	Farsetmore 39_2476	N	**Medium**: A number of residential properties in the upstream vicinity of Culvert S2-CUL30. Potential trout stream with 'slightly polluted' water quality (Q3-4).	Temporary Imperceptible

Site Reference/ Location	Estimated Material Volume (m^3)	Nearest Watercourse	Flooding Potential (Y/N)	Hydrological Importance Rating (TII Guidelines)	Impacts (Flooding)
S2.ME14 / Side Road Ch. 1+150 m	38,000	Farsetmore 39_2476	Liable to flooding (Y).	**Medium**: A number of residential properties in the upstream vicinity of Culvert S2-CUL30. Potential trout stream with 'slightly polluted' water quality (Q3-4).	Temporary Slight Impact
S2.ME15 / Mainline Ch. 0+900 m	112,000	Coaghmill 39_2151	N	**Low**: No commercial & residential properties are located in upstream / downstream the vicinity. Low quality, ephemeral, with no fisheries significance and poor water quality in the crossing reach.	Temporary Imperceptible
S2.ME16 / Mainline 2.4 - Ch. 0+900 m	285,000	Drumgreggan 39-1268	N	**Medium**: A number of commercial & residential properties are located in its vicinity. Low quality with no fisheries significance and poor water quality in the crossing reach.	Temporary Imperceptible

11.8.3.2.3 Section 3

Potential construction phase impacts on flood risk are summarised in Table 11-57, Predicted impacts associated with the road cutting, construction compounds & material depositions, and material extractions activities are also assessed and presented in Table 11-58, Table 11-59 and Table 11-60, respectively.

Manorcunningham Culverts

This addresses culverts S3-CUL.01, S3-CUL.02, S3-CUL.03, S3-CUL.04, S3-CUL.05 and S3-CUL.06: The culverts positioned between Mainline Chainage 0+500 and 1+150 are in an area which is subject to flooding. The road embankment through this region will be constructed of Starter 6A Material which will allow continuity of flow across the flood plain. All these culverts are to be constructed online, meaning a temporary diversion will be required parallel to the line of the culvert so that they can be constructed in the dry. The Contractors works will take account of the flooding threat in this region, and this area should not be used for the storage of excavated material, plant or construction materials.

Tullyrap Stream Diversion

Between the Chainages of 9,200 to 10,200, the Drumbeg stream is to be from its current course to the RHS of the mainline. A detail indicating the altered route is provided in the FRA. The diversion and the culvert at its take off point (S3-CUL.24), will be constructed in dry conditions prior to the introduction of live flows. Two minor streams which currently connect into the Drumbeg diversion at Chainages 9+800 and 9+850 will be diverted to Chainage 9+980 where they will cross the proposed sideroad and mainline via culverts S3-CUL.25 and S3-CUL.26. Any minor land drainage ditches will be connected to the interceptor ditch system which runs along to LHS of the alignment between Chainages 9+200 and 10+200. Downstream of the Tullyrap diversion, the Drumbeg stream will cross beneath the mainline at Chainage 10+370. This culvert will be bottomless, minimising instream works.

Swilly Burn Bridge

At Chainage 14+400, the mainline crosses the Swilly Burn River. A breakdown of the construction sequence has been provided below. Flood protection bunds, run along each side of the main river. Flows from the

adjacent farmlands enter OPW maintained arterial drainage channels which run behind these bunds. These channels are connected with the main Swilly Burn River Channel via non return valves which control the water which passes through the bunds. In the vicinity of the bridge structure, the OPW channel will be piped to allow continuity of flow through the mainline embankment/structure. The OPW stream will have to be piped prior to the installation of the main bridge works. The abutments are setback 5 m from the riverbank crest to provide a natural bank and enable a 3 m wide 'no working zone' behind the riverbank crests. No instream works are required. The Swilly Burn contains a population of the invasive alien Asian Clam (Corbicula fluminea). Refer to Chapter 9B Biodiversity – Aquatic, Section 9B.6.1.1 for biosecurity measures to ensure no risk of transference of this invasive species during the construction phase.

River Deele Bridge

At Chainage 14+400, the mainline crosses the Deele River. Flood protection bunds, run along each side of the main river. Flows from the adjacent farmlands enter OPW maintained arterial drainage channels which run behind these bunds. These channels are connected with the main River Deele Channel via non return valves which control the water passing from the OPW maintained channels to the River Deele itself. On the West Bank of the River, one of the OPW maintained non-return valves is to be relocated to facilitate the bridge construction. Near the bridge structure, the OPW channel will be piped to allow continuity of flow through the mainline embankment/ structure. The OPW stream will have to be piped prior to the installation of the main bridge works. Separate to the main bridge structure a number of flood alleviation culverts will be provided through the mainline embankment on the West side of the River Deele. These will regulate the flow flood plain across the embankment. These culverts will be installed during dry conditions when the river is not in flood. During normal flow conditions, there is minimal/no flow at the flood alleviation culvert locations.

N14/N15 to A5 Link (River Finn Bridge)

Section 3 of the Proposed Development includes the N14/N15 to A5 Link south of Lifford to the border with Northern Ireland on the River Finn where it will connect to a proposed Trunk Road T3 (A5 Western Transport Corridor to Land Frontier), which in-turn will connect to the proposed A5 Western Transport Corridor (WTC). A proposed Trunk Road T3 (of approximately 79 metres of new road) will provide a link between the proposed A5 WTC in Northen Ireland and the Project, meeting at the border between Northern Ireland and Ireland.

The A5 WTC team conducted a flood modelling assessment that included the proposed N14/N15 to A5 Link. The results showed that the N14/N15 to A5 Link will have a negligible effect on flood storage capacity.

The proposed N14/N15 to A5 Link, including the proposed bridge over the River Finn (i.e. the link between the N14/N15 Lifford Junction and a proposed Trunk Road T3) will not be constructed until such time as a proposed Trunk Road T3 / Section 1 of the A5 WTC has been constructed or is under construction. In the scenario without the N14/N15 to A5 Link, the flood impact will be marginally less.

Table 11-57: Section 3 Construction Phase Impact on Flood Risk

EPA River Name	Water Segment Code	Hydrological Importance Rating (TII Guidelines)	Proposed Development	Historical/predicted Flood Risk	Magnitude of Impact (TII Guidelines)	Significance of Effect (EPA, 2022)
Churchland 39	39_2497	**Low**: No residential or commercial properties are located in the immediate vicinity. Potentially fish bearing though currently with poor water quality.	Culverts S3-CUL.01 and S3-CUL.02, S3-CUL.03 to be constructed on watercourse. Associative mainline, sideroad and attenuation pond earthworks.	River Segment is Liable to 1% AEP flooding.	Temporary, Negligible	Imperceptible
Pluck	39_2506	**Medium**: Residential properties and Water works were identified approximately 200 meters upstream of culvert S3-CUL.04. Potentially fish bearing though currently with poor water quality.	Culverts S3-CUL.04 and S3-CUL.05 to be constructed on watercourse together with associative sideroad and mainline earthworks.	River Segment is Liable to 1% AEP flooding.	Temporary, Small Adverse	Slight
Pluck	39_481	**Medium**: Residential properties. Potentially fish bearing though currently with poor water quality.	Culvert S3-CUL.06 to be constructed on watercourse	River Segment is Liable to 1% AEP flooding.	Temporary, Small Adverse	Slight
Pluck	39_458	**Medium**: Residential properties. Potentially fish bearing though currently with poor water quality.	Culvert S3-CUL.07 to be constructed on watercourse	River Segment is Liable to 1% AEP Flood Risk	Temporary, Small Adverse	Slight
Drumoghill 39_208, Drumoghill 39_209 and Drumoghill 39_2535	Refer across	**Low:** No residential or commercial properties are located in the vicinity. Low quality drain with poor water quality and no fisheries potential.	39_208 to be diverted by watercourse diversion and Culverted by S3-CUL.08 and S3-CUL.09. 39_208 to be diverted by watercourse diversion. 39_2535 to be culverted by S3-CUL.10 and S3-CUL.11.	River segment is not identified to be liable to flooding	Temporary, Negligible	Imperceptible
Doorable	39_925	**Low**: No residential or commercial properties at risk in the vicinity. This onsite assessment classified this as a ditch which has limited potential to support fish with poor water quality.	Significant Watercourse Diversion. Culverts S3-CUL.12 and S3-CUL.13 to be constructed.	River segment is not identified to be liable to flooding	Temporary, Negligible	Imperceptible

EPA River Name	Water Segment Code	Hydrological Importance Rating (TII Guidelines)	Proposed Development	Historical/predicted Flood Risk	Magnitude of Impact (TII Guidelines)	Significance of Effect (EPA, 2022)
Pluck	39_926	**Low**: No residential or commercial properties at risk are in the vicinity. Potentially fish bearing though currently with poor water quality.	Culverts S3-CUL.14 and S3-CUL.15 to be constructed on watercourse	River segment is not identified to be liable to flooding	Temporary, Negligible	Imperceptible
Galdonagh Glebe	39_2109	**Low**: No residential or commercial properties at risk are in the vicinity. Low quality drain which currently has no fisheries potential.	Watercourse S3-CUL.17 to be constructed. Watercourse diversion to be provided.	River segment is not identified to be liable to flooding	Temporary, Negligible	Imperceptible
Skeskinapoll	01_384	**Low**: No residential or commercial properties at risk located in the vicinity. Upper reaches are a low-quality drain with poor water quality and no fisheries potential.	Culverts S3-CUL.18 and S3-CUL.19 to be constructed on watercourse.	River segment is not identified to be liable to flooding	Temporary, Negligible	Imperceptible
Skeskinapoll	01_385	**Medium**: No residential or commercial properties located in the vicinity. Potentially fish bearing though currently with poor water quality.	Watercourse diversion and Culvert S3-CUL-20 to be constructed	River segment is not identified to be liable to flooding	Temporary, Negligible	Imperceptible
Swilly Burn	01_1541,01_1548 and 01_1560	**High**: Significant river, with existing flood embankments each side. Water levels are tidally influenced in the proposed crossing reach. Migration and holding route for salmonids	Swilly Burn single span river bridge, flood alleviation culverts together with mainline, sideroad and access track earthworks.	River Segment is Liable to 1% AEP Flood Risk	Temporary, Small Adverse	Moderate/Slight
Drumbeg/Carnshannagh	01_191, 01_292, 01_293, 01_1114 and 01_1332	**Medium**: Residential properties are in the vicinity. Potentially fish bearing though currently with poor water quality.	Existing watercourses to be diverted and culverts S3-CUL-24, S3-CUL.25 and S3-CUL.26 to be provided. Culvert S3-CUL.27 is to be a bottomless culvert, together with mainline, sideroad and access track earthworks.	River Segment is Liable to 1% AEP Flood Risk	Temporary, Small Adverse	Slight

EPA River Name	Water Segment Code	Hydrological Importance Rating (TII Guidelines)	Proposed Development	Historical/predicted Flood Risk	Magnitude of Impact (TII Guidelines)	Significance of Effect (EPA, 2022)
Tullyrap	01_907	**Medium**: Residential properties are in the vicinity. Potentially fish bearing though currently with poor water quality.	Culverts S3-Cul.28 and S3-Cul.29 together with watercourse diversion	River segment is not identified to be liable to flooding	Temporary, Negligible	Imperceptible
Deele River	01_1541, 01_1548 and 01_1560	**Very High**: County Importance – salmonid holding and migration route. Tends to flood. The village of Ballindrait is located upstream of the proposed crossing point. Water levels are tidally influenced in the proposed crossing reach.	A three-span bridge is to be provided across the river. Flood alleviation culverts are to be provided each side of the bridge	River segment is Liable to 1% AEP Flood Risk	Temporary, Negligible	Imperceptible
Tyleford	01_1718	**Medium:** Residential properties are in the vicinity.	Culvert S3-CUL.30 is to be provided on the existing watercourse	River segment is not identified to be liable to flooding	Temporary, Negligible	Imperceptible
Cavancor	01_1786	**Low**: No residential or commercial properties at risk located in the vicinity. Potentially fish bearing though currently with poor water quality.	Culvert S3-CUL.31 is to be provided on the existing watercourse	River segment is not identified to be liable to flooding	Temporary, Negligible	Imperceptible
Murlough 01	01_1558	**Medium:** Residential properties are in the vicinity. Low-quality drain**.**	Culvert S3-CUL.32 is to be provided on the existing watercourse	River segment is not identified to be liable to flooding	Temporary, Negligible	Imperceptible
Ballynabreen	01_1519	**Medium:** Residential properties are in the vicinity. Potentially fish bearing though currently with poor water quality.	Culvert S3-CUL.33 is to be provided on the existing watercourse	River segment is not identified to be liable to flooding	Temporary, Negligible	Imperceptible
River Finn	01_7109	**Extremely High:** River Finn SAC - of International Importance. Records of flooding along the channel. Urban Lifford / Strabane immediately downstream.	The A5 Link Bridge is to be provided on the River Finn.	River Segment is Liable to 1% AEP Flood Risk	Temporary, Negligible	Imperceptible

Table 11-58: Section 3 Construction Stage Impacts Road Cutting Areas

Cutting Location	Receiving Watercourse (EPA Name)	Receiving Watercourse (EPA Code)	Mitigation	Impacts (Flooding)
Mainline Chainage 0 to 350	Churchland	39_2497	Temporary attenuation pond at site of Attenuation Pond 01 incorporating silt trapping measures.	Temporary, Imperceptible Impact
Mainline Chainage 1+330 to 1+730	Pluck	39_481	Flow and silt controls to be placed at Chainage 1+330 prior to discharging to receiving watercourse.	Temporary, Imperceptible Impact
Mainline Chainage 3+500 to 4+100	Drumoghill	39_208	Flow and silt controls to be placed at Chainage 3+680 prior to discharging to receiving watercourse.	Temporary, Imperceptible Impact
Mainline Chainage 4+600 to 5+200	Pluck	39_926	Flow and silt controls to be placed at Chainage 4+600 prior to discharging to receiving watercourse.	Temporary, Imperceptible Impact
Mainline Chainage 5+800 to 6+400	Skeskinapoll	01_384	Flow and silt controls to be placed at Chainage 6+500 prior to discharging to receiving watercourse.	Temporary, Imperceptible Impact
Mainline Chainage 7+100 to 7+300	Skeskinapoll	01_385	Flow and silt controls to be placed at Chainage 7+300 prior to discharging to receiving watercourse.	Temporary, Imperceptible Impact
Mainline Chainage 8+600 to 8+930	Drumbeg	01_292	Flow and silt controls to be placed at Chainage 8+950 prior to discharging to receiving watercourse.	Temporary, Imperceptible Impact
Mainline Chainage 10+130 to 11+000	River Swilly	01_1541,01_1548 and 01_1560	Flow and silt controls to be placed at Chainage 11+000 prior to discharging to receiving watercourse.	Temporary, Imperceptible Impact
Mainline Chainage 12+800 to 13+400	Tullyrap	01_907	Flow and silt controls to be placed at Chainage 12+800 prior to discharging to receiving watercourse.	Temporary, Imperceptible Impact
Mainline Chainage 12+800 to 13+920	River Deele	01_1541, 01_1548 and 01_1560	Flow and silt controls to be placed at Chainage 13+920 prior to discharging to receiving watercourse.	Temporary, Imperceptible Impact
Mainline Chainage 14900 to 16500	Cavancor	01_1786	Flow and silt controls to be placed at Chainage 14+950 prior to discharging to receiving watercourse.	Temporary, Imperceptible Impact

Table 11-59: Section 3 Potential Impacts of Material Deposition Areas and Compounds

Site Reference	Description	Nearest Watercourse	Flooding Potential (Y/N)	Impacts (Flooding)
Mainline Chainage 0+200 RHS	Temporary site for Contractor offices/ plant. Including material and bulk fuel storage.	Churchland 39(39_2497)	N	Imperceptible
Mainline Chainage 2+400 RHS	Permanent Subsoil Storage	Drumoghill (39_2535)	N	Imperceptible
Mainline Chainage 5+600 LHS	Permanent Subsoil Storage	39_2109 Galdonagh_Glebe	N	Imperceptible
Mainline Chainage 7+500 LHS	Permanent Subsoil Storage	01_385 Sheskinapoll	N	Imperceptible
Mainline Chainage 7+800 RHS	Permanent Subsoil Storage	01_385 Sheskinapoll	N	Imperceptible
Mainline Chainage 7+850 RHS	Temporary site for Contractor offices/ plant. Including material and bulk fuel storage.	01_385 Sheskinapoll	N	Imperceptible
Mainline Chainage 12+100 LHS	Permanent Subsoil Storage	01_907 Tullyrap	N	Imperceptible
Mainline Chainage 14+150 LHS	Permanent Subsoil Storage	River Deele	N	Imperceptible

Table 11-60: Section 3 Potential Impacts Associated with Material Extraction Activities

Site Reference/Location	Estimated material volume (m^3)	Closest Watercourse	Flooding Potential (Y/N)	Impacts (Flooding)
S3.ME01/Mainline Chainage 2+400	49,600	39_2535 Drumoghill	N	Imperceptible
S3.ME02/Mainline Chainage 8+800	94,176	01_292 Drumbeg	N	Imperceptible
S3.ME03/Mainline Chainage 12+900	162,894	01_907 Tullyrap	N	Imperceptible
S3.ME04/Mainline Chainage 13+200	7,921	01_907 Tullyrap	N	Imperceptible
S3.ME05/Mainline Chainage 13+700	34,153	01_1852, 01+1503, 01_320 and 01_464 Deele	N	Imperceptible
S3.ME06/Mainline Chainage 13+750	74,796	01_1852, 01+1503, 01_320 and 01_464 Deele	N	Imperceptible
S3.ME07/Mainline Chainage 15+300	62,926	01_1520 Lifford	N	Imperceptible
S3.ME08/Mainline Chainage 16+000	20,237	Ballynabreen 01_1519	N	Imperceptible
S3.ME09/Mainline Chainage 16+300	17,403	Ballynabreen 01_1519	N	Imperceptible

11.8.3.3 Impact on WFD Status and Hydromorphology

The WFD Compliance Evaluation set out in Appendix C11.04 provides the examination of impact on Article 4(1) objective status of surface waterbodies with regards to supporting hydromorphological quality elements as defined in Annex V of the Directive. This provides a detailed assessment of the implications of the Proposed Development in terms of its residual effects on WFD objectives for directly and indirectly affected surface water bodies relevant to the Proposed Development. Refer to EIAR Drawings 9B.01 through 9B.03, which contain maps showing EPA water body names in relation to aquatic survey sites and EPA named watercourses referenced in throughout this Chapter. The WFD Compliance Assessment considers the impact of the Proposed Development on hydromorphological quality elements as defined in the WFD, which in turn underpin the biological quality elements that ultimately define surface water body status.

All water bodies relevant to the Proposed Development have been assigned formal status by the EPA as part of the most current data reporting period (2019-2024). EPA assigned status (2019-2024) was used as the baseline against which WFD compliance was assessed for this project. The WFD objective for all affected water bodies affected by the Proposed Development is good status. There are no High-Status Objective (HSO) water bodies impacted by the Proposed Development.

The WFD compliance evaluation concludes, through a process set out in WFD Common Implementation Strategy (CIS) Guidance (EC, 2017) that the Proposed Development, by design and with mitigations implemented as prescribed in this Chapter and Chapter 9B: Biodiversity – Aquatic, will not cause deterioration of status in any surface water body (overall or at individual quality element at water body level) nor will it prevent the achievement of good status, which is in line with WFD Article 4(1) objectives.

11.8.3.4 Project Wide Construction Phase Impacts

In a very conservative scenario whereby no mitigations were employed around sediment and pollutant loss control (which is unlikely to be the case) and all three sections of the Proposed Development were to occur simultaneously:

- There is potential for temporary to short term direct and indirect significant negative project wide effects on water quality and associated aquatic habitats of River Finn/Foyle (Section 1 and Southern Section 3) and Swilly Estuary (Section 2 and Northern Section 3).
- There is also potential for temporary to short term direct and indirect significant negative project wide effects on flooding in the construction phase of River Finn (Sections 1 and 3) and Swilly Estuary (Sections 2 and 3).
- Refer to Chapter 19 Cumulative Impact Assessment for cumulative effects with other plans and projects.

11.8.4 Operational Phase Impacts

11.8.4.1 Impact on Water Quality

The operational phase impact of the Proposed Development on water quality primarily relates to the watercourse's ability to support aquatic organisms. Operational phase water quality effects have been comprehensively described and assessed in Chapter 9B: Biodiversity – Aquatic, refer to Section 9B.5.4. HEWRAT assessment results showed no acute or chronic exceedance of copper or zinc concentrations at mainline outfalls, individually or cumulatively, and annual average concentrations do not exceed the EQS for these metals.

Spillage risk assessment results show that the annual probability of a serious PINCs are well below the acceptable risk limit of 0.5% for each of the three road sections.

The following design measures ameliorate operational phase effects on water quality:

- Attenuation ponds are designed as hybrid wetlands, so they provide both an attenuation function and a water treatment function. The ponds will be planted with vegetation suitable for the specific zone of the pond the planting is located e.g. permanently wet, marginal zones, dry earthworks slopes.
- Rock armour has been proposed at the inlets/outlets of all culverts in order to reduce any risk of scouring in the channel beds.
- Sustainable road drainage systems, e.g., filter drain, grass surface water channels are generally proposed. However, areas where groundwater vulnerability risks are high, concrete channels and sealed drainage systems are proposed.
- There are no surface water abstraction points affected in Sections 1, 2 or 3. The fisheries amenity value of large rivers (Finn, Swilly, Swilly Burn and Deele will not be affected as bridges have sufficient head clearance and abutment set backs for access along the river banks.

The operational phase effects on water quality and amenity value are long term imperceptible negative and **not significant**.

11.8.4.2 Impact on Flood Risk

The additional hard standing over existing greenfield areas due to the construction of the mainline and active travel routes have the potential to increase peak run-off rates, which could further exacerbate flood risk in the area. This is managed by the proposed drainage design described in Chapter 4: Project Description.

11.8.4.2.1 Section 1

Table 11-61 presents the predicted impact on flood risk during the operation phase of Section 1.

Drainage & Flood Risk Summary: Encroachments within the watercourse floodplains have been minimised in the design. Any increases in flood levels due to flood volume storage loss caused by encroachments of road embankments in the existing floodplains or from any increased road runoff volume, are predicted to be imperceptible.

A slight increase in flood level in the upstream vicinity of some culvert crossings is predicted. This is very localised and within in the OPW Section 50 guidelines specified headloss of 300 mm in all cases and will not cause any flooding to adjacent lands and properties.

Road runoff is proposed to be attenuated up to the 1%AEP greenfield runoff rates through 22 no. attenuation ponds, that have been sized accordingly through hydraulic modelling, before discharging into the natural watercourses via 22 no. outfalls. At all culvert and bridge crossings adequate freeboard is available (>300 mm) under the design 1%AEP (+20% CCA) flood condition. OPW consents under Section 50 of the Arterial Drainage Act 1945 for construction or alteration works on bridges and culverts were obtained.

In most cases, there is long term direct and indirect imperceptible to slight effects on flood risk that is **not significant**.

There was one long term direct moderate/slight effect identified at the River Burn Daurnett adjacent to the proposed Dooish Junction in Section 1 with a slight increase in inundated flood areas from the existing to proposed scenarios under the design flood condition. The impact is considered a small adverse with imperceptible increase in flood level in the upstream vicinity of the proposed road. Flood volume storage loss is likely to occur due to road embankment encroachment. This was accounted for in the design by provision of a flood compensation area as shown in EIAR Drawing 4.1.

Table 11-61: Section 1 Operation Phase Impacts on Flood Risk

EPA River Name	Watercourse Segment Code	Hydrological Importance Rating (TII Guidelines)	Proposed Development	Magnitude of Impact (TII Guidelines)	Significance of Effect (EPA (2022)
Burn Daurnett	01_1815	**High:** River is salmon spawning tributary of River Finn. No residential or commercial properties located in the vicinity and this stream segment. Water quality Q3-4 (EPA 2022 data)	The proposed tie-in with the existing N15 encroaches the 1%AEP flood extent of this stream segment at Ch. 0+300. Attenuated road runoff outfalls into this stream segment at Ch. 0+300 (outfall no.14).	**Small adverse** Imperceptible increase in flood level in the upstream vicinity of the proposed road. Flood volume storage loss likely to be caused by road embankment encroachment is found to be minimal.	Moderate/slight
Un-named (Trib. of Burn Daurnett)	01_1826	**Medium:** no residential or commercial properties located in the vicinity. Stream segment is a small trout stream (high local importance).	Culvert S1-CUL01 is located on this segment of the stream at CH1+300 and a short section of the stream is proposed to be diverted at the upstream vicinity of the culvert.	**Small adverse** Imperceptible increase in flood level in the upstream vicinity of the proposed road. Flood volume storage loss likely to be caused by road embankment encroachment is found to be minimal.	Slight
Cappry	01_1816	**Low:** no residential or commercial properties located in the vicinity. Stream segment is of low ecological importance.	The upstream section of this stream segment, located at CH0+100 (mainline, north of the proposed junction with existing N15) has been diverted through a number of culverts (CUL08, CUL09, CUL10 & CUL11). Attenuated road runoff from the ponds no. 12 & 13.	**Small Adverse**: Slight increase in flood level in the vicinity due to the headlosses caused by a series of culverts.	Imperceptible
Finn [Donegal]	01_810, 01_7147, 01_590, 01_591	**Extremely High:** River Finn bridge upstream of urban Ballybofey/ Stranorlar. Designated SAC and Salmonid Water. Water quality Q4-5 (EPA 2022 data)	A seven-span 360 m long bridge structure is proposed over the River Finn (between CH2+225 and CH2+585) with no piers within the main river channel. The stream segment 01_589 has been proposed to be diverted at mainline CH3+050 through two culverts - CUL12 & CUL13. Attenuated road runoff will outfall to River Finn Segment 01_810 via outfall nos. 11 & 10 and to the tributary stream segment 01_589 via outfalls no. 8 & 9.	**Negligible**: Imperceptible increase in flood level in the vicinity (upstream and downstream) of the proposed Finn River Bridge crossing. Any potential loss of flood volume storage likely to be caused by road embankment encroachment is also found to be minimal.	Imperceptible

EPA River Name	Watercourse Segment Code	Hydrological Importance Rating (TII Guidelines)	Proposed Development	Magnitude of Impact (TII Guidelines)	Significance of Effect (EPA (2022)
Aghasheil	01_553	**Medium:** A number of residential properties located in the eastern vicinity of this stream segment. Low aquatic ecological value.	Culvert S1-MWC13 is located on the Ballybofey link road at CH0+800.	**Negligible:** stream segment is not identified as at flood risk. No road runoff is proposed to discharge in this stream. Proposed culvert adequately sized to avoid any flood risk in its upstream vicinity.	Imperceptible
Drumboe Lower	01_589	**Extremely High:** No residential or commercial properties located in the vicinity, but lower reaches of the stream are within River Finn SAC and support juvenile salmonids. Water quality Q3 (project specific data 2024)	The subject stream segment has been diverted slightly at the northern vicinity of the mainline carriageway and two culverts S1-CUL12 & S1-CUL13 are proposed under two access roads. The stream passes under the mainline carriageway as roadside drain along a local road (underpass) at CH3+050. Attenuated road runoff will outfall to this stream via outfall no. 8.	**Negligible:** stream segment is not identified as at flood risk. Road runoff will be attenuated to the predevelopment stage, therefore there will be no increase in flood volume. Proposed culverts adequately sized to avoid any flood risk in its upstream vicinity.	Imperceptible
Greenhills 01	01_70	**Medium:** A number of commercial & residential properties are in its vicinity. Low quality, largely ephemeral drain with low ecological significance.	The subject stream segment has been culverted under the mainline carriageway at CH4+825 (S1-CUL15) and under two other access/link roads (S1-CUL16 & S1-CUL17). Attenuated road runoff via outfall no. 6.	**Negligible:** stream segment is not identified as at flood risk. Road runoff will be attenuated to the predevelopment stage, therefore there will be no increase in flood volume. Proposed culvert has been adequately sized to avoid any flood risk in its upstream vicinity.	Imperceptible
Backlees	01_186	**Medium:** A number of commercial & residential properties are in its upstream/downstream vicinity. Small trout stream. Water quality Q3 (project specific data 2024)	This segment of the Backlees river channel is proposed to be culverted under an access road (S1-CUL14) and a 52 m single span bridge has been proposed at mainline CH4+150. Attenuated road via outfall no. 07.	**Small Adverse:** Slight increase in flood level in the vicinity (upstream and downstream) of the proposed Backlees River Bridge crossing. Any flood volume storage loss likely to be caused by road embankment encroachment is also found to be minimal.	Slight
Kilross 01	01_543	**Medium:** A number of commercial & residential properties are in its upstream/downstream vicinity. Lough Alaan downstream (fisheries amenity	This stream segment is in close vicinity of the northern link road. However, the Proposed Development will not encroach its floodplain.	No flood impacts are anticipated to the subject watercourse.	Imperceptible

EPA River Name	Watercourse Segment Code	Hydrological Importance Rating (TII Guidelines)	Proposed Development	Magnitude of Impact (TII Guidelines)	Significance of Effect (EPA (2022)
		value). Low ecological quality, largely ephemeral in upper reaches.			
Tircallan	01_3 & 01_04	**Medium:** A small number of residential properties are in its upstream/downstream vicinity. Small trout spawning/nursery stream. Water Quality Q3-4 (project specific field data)	The stream segment 01_04 is proposed to be culverted at two locations on the proposed northern link road (S1-CUL21 & S1-CUL22). Attenuated road runoff via outfall no. 03.	**Negligible:** stream segment is not identified as at flood risk. Road runoff will be attenuated to the predevelopment stage, therefore there will be no increase in flood volume. Proposed culvert adequately sized to avoid any flood risk in its upstream vicinity.	Imperceptible
Mullaghagarry	01_69	**Medium:** No residential or commercial properties in the vicinity and these stream segments. Small trout spawning / nursery tributary system of River Finn. Water quality Q3-4 / Q4 (project specific field data).	It is proposed to divert the 01_67 stream segment north of an access road and join with the stream segment01_69 and the combined flow passes through a Culvert under the access road (S1-CUL25), which further downstream discharges into the stream segment 01_68.	**Small Adverse:** Slight increase in flood level in the vicinity (upstream and downstream) of the proposed culvert crossings. Any flood volume storage loss likely to be caused by road embankment encroachment is also found to be minimal.	Imperceptible
Castlebane 01	01_67				
Mullaghagarry	01_68	**Medium:** No residential or commercial properties located in the vicinity and this stream segment. Small trout spawning / nursery tributary of River Finn. Water quality Q3-4 / Q4 (project specific field data).	The northern link road runs along the close vicinity of this river segment between CH2+000 and CH2+250. Attenuated road runoff discharges into this stream segment via outfall no 15.	**Negligible:** stream segment is not identified as at flood risk. Road runoff will be attenuated to the predevelopment stage, therefore there will be no increase in flood volume.	Imperceptible
Treanamullin	01_66	**Low:** No residential or commercial properties located in the vicinity. Ephemeral drain of low ecological quality.	This stream segment is proposed to be culverted under the northern link road at CH2+475 (S1-CUL27).	**Negligible:** stream segment is not identified as at flood risk. No runoff is proposed to be discharged into this stream channel and the culvert is sized adequately to reduce any afflux upstream of the proposed culvert.	Imperceptible
Mullaghagarry	01_776	**Medium:** No residential or commercial properties located in the vicinity and this stream segment. Small trout spawning / nursery tributary of River Finn. Water	The N15 tie in junction will be located within the 1% AEP flood extent and the Mullaghgarry River channel will be culverted under this tie in road at CH0+150). Proposed attenuated road	**Small adverse:** Imperceptible increase in flood level in the upstream vicinity of the proposed road. Flood volume storage loss likely to be caused by road	Slight

EPA River Name	Watercourse Segment Code	Hydrological Importance Rating (TII Guidelines)	Proposed Development	Magnitude of Impact (TII Guidelines)	Significance of Effect (EPA (2022)
		quality Q3-4 / Q4 (project specific field data).	runoff to this river segment via three outfalls (Outfall no.4, 16 & 5).	embankment encroachment is found to be minimal.	
Lisnaree	01_928	**Medium:** A number of residential properties are in its downstream vicinity. Ephemeral, channelised drain of low ecological quality.	The subject stream segment is proposed to be culverted under the local link/access roads at two locations (S1-CUL30 & S1-CUL33). It is also proposed to divert some section immediately upstream of its confluence with the stream segment 01_1024. Attenuated road runoff from the junction area is proposed to be discharged into this stream segment via outfall no. 19.	**Negligible:** stream segment is not identified as at flood risk. The culvert is sized adequately to reduce any afflux upstream of the proposed culvert. No increase in flood volume is expected from the road runoff since it will be attenuated before discharging into the river.	Imperceptible
Magheracorran	01_1024	**Medium:** A number of residential properties are in its upstream/downstream vicinity. Small trout spawning / nursery tributary of Cloghroe River (Deele). Water quality Q3-4 /Q4 (project specific field data).	The subject stream segment is proposed to be culverted under a local link road (S1-CUL34) and under the mainline carriageway at CH8+500 (S1-CUL36). Attenuated road runoff from the junction area is proposed to be discharged into this stream segment via outfall no. two.	**Negligible:** stream segment is not identified as at flood risk. The culverts are sized adequately to reduce any afflux upstream of the proposed culvert. No increase in flood volume is expected from the road runoff, since it will be attenuated before discharging into the river	Imperceptible
Magheracorran	01_1530	**Medium** a number of residential properties are in its upstream/downstream vicinity.	The subject stream segment is proposed to be culverted under a local link road (S1-CUL31). Attenuated road runoff from the junction area is proposed to be discharged into this stream segment via outfall no. one.	**Negligible:** stream segment is not identified as at flood risk. The culverts are sized adequately to reduce any afflux upstream of the proposed culvert. No increase in flood volume is expected from the road runoff since it will be attenuated before discharging into the river.	Imperceptible
Cloghroe 010	01_1796	**Medium:** A number of residential properties are in upstream/downstream vicinity. Salmonid spawning / nursery tributary of River Deele. Water quality Q3 (project specific field data).	The proposed tie-in road embankment with the existing N13 (between CH0+050 and CH0+450 is located within the 1% AEP flood plain. An 18 m single span bridge has been proposed over the Cloghroe channel (CH0+300). Attenuated road runoff is proposed to be discharged via outfall no. 21.	**Small Adverse:** Slight increase in flood level in the vicinity due to flood volume storage loss likely to be caused by the road embankment.	Slight

11.8.4.2.2 Section 2

Table 11-62 presents the predicted flood risk impacts for the operation stage of Section 2. Note that all watercourses discharge to the River Swilly Estuary, which is a Transitional waterbody and located within the Lough Swilly SAC (002287). The Hydrological Importance (NRA, 2008) assigned to the individual watercourse segments relates to the local attributes.

Drainage & Flood Risk Summary: A slight increase in flood level in the upstream vicinity of some culvert crossings is predicted. This is very localised and within in the OPW section 50 Guidelines specified headloss of 300 mm in all cases and will not cause any flooding to the adjacent lands and properties.

At all crossings, encroachments within the watercourse floodplains have been minimised such that any increase in flood levels in the upstream or downstream vicinity due to flood volume storage loss would be minimal. Increased road runoff is proposed to be attenuated to 1% AEP greenfield runoff rates though 12 no. attenuation ponds before discharging into the natural watercourses via 12 no. outfalls. At all culvert and bridge crossings adequate freeboard are available (>300 mm) under the design 1%AEP flood condition. OPW consents for the section 50 of the Arterial Drainage Act 1945 for construction or alteration works on bridges and culverts were obtained.

Any increases in flood levels due to flood volume storage loss likely to be caused by any encroachments of road embankments in the existing floodplains or from any increased road runoff volume, are predicted to be imperceptible. In most cases, there is long term direct and indirect imperceptible to slight effects on flood risk.

There is one operational phase long term direct significant effect on the River Swilly floodplain at Bonagee Junction with a slight increase in inundated flood areas from the existing to proposed scenarios under the design flood condition. This has been addressed through provision of flood storage compensation areas as outlined in mitigation Section 11.10.2.

Table 11-62: Section 2 Operation Phase Impacts on Flood Risk

EPA River Name	Watercourse Segment Code	Hydrological Importance Rating (TII Guidelines)	Proposed Development	Magnitude of Impact (TII Guidelines)	Significance of Effect (EPA (2022)
Un-named (at Drumany)	39_1545	**Medium:** A number of residential properties located in the western vicinity of this stream segment (at road Ch. 2+100). Low ecological value with no fisheries significance and poor water quality.	This stream crosses the Mainline 2.1 at t Ch. 1+411 (S2-CUL13). Proposed N13 road adjacent to Dromore junction (between Ch. 1+900 and 2+100) encroaches into the CFRAM study estimated 1% AEP flood extent.	**Small Adverse:** No road runoff is proposed to discharge into this stream. Proposed culvert has been adequately sized to avoid any flood risk in its upstream vicinity. Any flood volume storage loss likely to be caused by road embankment encroachment is also found to be minimal.	Slight
Un-named (at Dromore Lower)	39_1544	**Medium:** A number of residential and commercial properties are located in the western vicinity of Dromore junction. Low ecological value with no fisheries significance and poor water quality.	This stream crosses the proposed L-1114 realignment at Ch. 0+130 (S2-CUL16) the NX-2000 Link road at Ch. 1+830 (S2-CUL17) & Ch.1+630 (S"-CUL18) and the LX-2011 Connector Road at Ch.0+550 (S2-CUL19). Some roads associated with the Bonagee and Dromore junctions are located within the 1% AEP flood extents of the River Swilly and the Dromore Upper Stream (CFRAM).	**Small Adverse**: Slight increase in flood level in the vicinity due to the headlosses caused by a series of culverts. Any flood volume storage loss likely to be caused by road embankment encroachment is found to be minimal.	Slight
Bunnagee	39_2934 & 39_1288	**Medium:** A commercial property located in the eastern vicinity of this stream segment. Low-quality drain.	The proposed LX-2200 Link road crosses this stream segment at Ch. 0+150 (S2-CUL20). The LX-2300 Tie-in road, east of Bonagee junction encroaches the Dromore and River Swilly 1% AEP flood extents (CFRAM).	**Small Adverse**: Slight increase in flood level in the vicinity due to the headlosses caused by a series of culverts. Any flood volume storage loss likely to be caused by road embankment encroachment is found to be minimal. Adequate compensation storage is proposed for this.	Slight

EPA River Name	Watercourse Segment Code	Hydrological Importance Rating (TII Guidelines)	Proposed Development	Magnitude of Impact (TII Guidelines)	Significance of Effect (EPA (2022)
Un- named (at Dromore)	39_1021 & 39_225	**Medium,** a number of residential and commercial properties are located in the upstream vicinity of a proposed culvert crossing (S2-CUL20). Low ecological value with no fisheries significance and poor water quality.	The stream segment 39_1021 has been proposed to be diverted under the mainline at Ch. 0+200 towards the Dromore Upper stream. The LX-2320 link road crosses the Dromore Upper stream at Ch.0+695 (S2-UL28). These river segments in the vicinity Proposed Development was not identified as liable to flooding under the CFRAM study.	**Negligible:** Imperceptible increase in flood level in the upstream vicinity of the proposed culvert crossing.	Imperceptible
Dromore 39	39_2954	**Medium:** No residential or commercial properties are located in the vicinity. Low quality with no fisheries significance and poor water quality in the crossing reach.	The proposed LX-2300 Tie in crosses the Dromore 39 at Ch. 0+325 (S2-CUL27). The eastern edge of Bonagee junction encroaches the Dromore and River Swilly 1% AEP flood extents (CFRAM). Furthermore, attenuated road runoff will outfall to this stream via outfall no. 5.	**Small Adverse:** Imperceptible increase in flood level in the upstream vicinity of the proposed culvert crossing. Any flood volume storage loss likely to be caused by road embankment encroachment is found to be minimal. Adequate compensation storage is proposed for this.	Slight
Drumgreggan	39_1268	**Medium:** A number of commercial & residential properties are located in its vicinity. Low quality with no fisheries significance and poor water quality in the crossing reach.	The proposed link road west of the Trimnagh Interchange encroaches to the low-lying floodplain of this Drumgreggan stream channel (between Ch. 0+450 and Ch. 0+710). However, this was not identified at flood risk in the CFRAM study.	**Negligible:** the subject stream segment is not identified as at flood risk. Any flood volume storage loss likely to be caused by road embankment encroachment is found to be minimal.	Imperceptible
Maghera_More 39	39_413	**Low:** No commercial & residential properties are located in its upstream/downstream vicinity.	The mainline carriageway crosses the Maghera_More Stream at Ch. 2+928 (S2-CUL34). This stream segment was not identified at flood risk in the CFRAM study.	**Negligible:** Imperceptible increase in flood level in the upstream vicinity of the proposed culvert crossing.	Imperceptible
Trimragh	39_412	**Low:** A small number of residential properties are located in the upstream vicinity of its crossing with the proposed mainline carriageway. Low quality, ephemeral, with no fisheries	The mainline carriageway crosses the Trimragh stream at Ch. 2+635 (S2-CUL33). Also the Proposed Development encroaches slightly the low-lying floodplain of the Trimragh stream channel. This stream segment	**Negligible:** Imperceptible increase in flood level in the upstream vicinity of the proposed culvert crossing.	Imperceptible

EPA River Name	Watercourse Segment Code	Hydrological Importance Rating (TII Guidelines)	Proposed Development	Magnitude of Impact (TII Guidelines)	Significance of Effect (EPA (2022)
		significance and poor water quality in the crossing reach.	though was not identified at flood risk in the CFRAM study.		
Maghera_More 39	39_576	**Low:** No commercial & residential properties are located in the vicinity. Low quality, ephemeral, with no fisheries significance and poor water quality in the crossing reach.	This river segment is not going to be affected by the Proposed Development works, other than attenuated road runoff is proposed to be discharged into this this stream channel via outfall no. 10. This stream segment though was not identified at flood risk in the CFRAM study.	**Negligible:** No increase in flood risk is anticipated due to the Proposed Development since attenuated road runoff will be discharged into this watercourse.	Imperceptible
Leslie Hill (Stream)	39_741	**Extremely High:** Tidal reach of 'Isle Burn' flowing to Swilly Estuary. At boundary of Lough Swilly SAC (002287)	The mainline carriageway crosses this stream at Ch. 3+400. The stream passes under a local access road (Isle Burn Footbridge). The proposed N13 road encroaches the 1% AEP flood extents of this stream (between Ch.3+350 and Ch.3+450.	**Negligible:** No increase in flood risk is anticipated due to the Proposed Development.	Imperceptible
Farsetmore	39_2476	**Medium:** A number of residential properties in the upstream vicinity of Culvert S2-CUL30. Potential trout stream with 'slightly polluted' water quality (Q3-4).	The mainline carriageway crosses this stream at Ch.1+200. This stream also passes under the Trimnagh Interchange through a number of culverts (S2-CUL29, 30, 31 & 32). The proposed link road north of the Trimnagh Interchange encroaches to the low-lying floodplain of the River Swilly and Farsetmore stream 1%AEP flood extents (CFRAM Study). Furthermore, attenuated road runoff will outfall to this stream via outfall no. 9.	**Small Adverse**: Slight increase in flood level in the vicinity due to the headlosses caused by a series of culverts. Any flood volume storage loss likely to be caused by road embankment encroachment is found to be minimal. Adequate compensation storage is proposed for this.	Slight
Coaghmill	39_2151	**Low:** No commercial & residential properties are located in upstream / downstream the vicinity. Low quality, ephemeral, with no fisheries significance and poor water quality in the crossing reach.	The proposed L-5784 realignment crosses the Coaghmill stream at Ch. 0+160 and also a stretch of this road encroaches its floodplain in the upstream vicinity of the proposed culvert crossing (S2-CUL11). This stream segment was not identified at flood risk in the CFRAM study. Furthermore,	**Negligible**: Imperceptible effects since the subject stream segment is not identified as at flood risk. Any flood volume storage loss likely to be caused by road embankment encroachment is found to be minimal.	Imperceptible

EPA River Name	Watercourse Segment Code	Hydrological Importance Rating (TII Guidelines)	Proposed Development	Magnitude of Impact (TII Guidelines)	Significance of Effect (EPA (2022)
			attenuated road runoff will outfall to this stream via outfall no. 3.		
Swilly 39 (& Corravaddy Burn)	39_2718 & 39_2724	**Extremely High**: A number of residential & commercial properties are in its upstream/downstream vicinity. Crossing of River Swilly Estuary Transitional waterbody within the Lough Swilly SAC (002287).	The proposed Letterkenny link road crosses the River Swilly at CH0+520. Much of the proposed Bonagee Junction and the Swilly River Bridge approach road are located within the 1% AEP floodplains of River Swilly and Carravaddy River.	**Small Adverse:** Imperceptible increase in flood level in the upstream vicinity of the proposed bridge crossing. Flood volume storage loss likely to be caused by road embankment encroachment is found to be minimal.	Significant

11.8.4.2.3 Section 3

Table 11-63 presents the predicted flood risk impacts for the operation stage of Section 3.

Drainage and Flood Risk Summary: A slight increase in flood level in the upstream vicinity of the proposed bridge and culvert crossings is predicted. This is very localised and within the OPW section 50 Guidelines specified headloss of 300 mm in all cases. Road drainage networks will outfall to attenuation ponds where surface water will be stored and released at greenfield runoff rates to receiving streams.

At all crossings, encroachments within the watercourse floodplains have been minimised such that any increase in flood levels in the upstream or downstream vicinity due to flood volume storage loss would be minimal. Increased road runoff is proposed to be attenuated to 1% AEP greenfield runoff rates though 23 no. attenuation ponds before discharging into the natural watercourses. At all culvert and bridge crossings adequate freeboard are available (>300 mm) under the design 1% AEP flood condition. OPW consents for the section 50 of the Arterial Drainage Act 1945 for construction or alteration works on bridges and culverts were obtained.

Table 11-63: Section 3 Operation Phase Impacts on Flood Risk

EPA River Name	Watercourse Segment Code	Hydrological Importance Rating (TII Guidelines)	Proposed Development	Magnitude of Impact (TII Guidelines)	Significance of Effect (EPA (2022)
Churchland 39	39_2497	**Low**: No residential or commercial properties located in the immediate vicinity. Potentially fish bearing though currently with poor water quality.	The proposed N14 road embankment, the proposed cycle track and access track AR 3.03 impose on the 1% AEP Flood extent in the vicinity of this stream. Attenuation Pond 02 (N14 Mainline) and Attenuation Pond 17 (Manorcunningham Local Road L1294) outfalls to this stream (Outfall 2). This stream also receives surface water from a number of interceptor drains and access tracks. This stream is culverted by S3-CUL.01, S3-CUL.02 and S3-CUL.03.	**Negligible:** Mainline drainage to watercourse reduced to greenfield rate. Attenuation Pond 17 will reduce surface water flows from the Manorcunningham Local Road (L1294) to greenfield levels. Check dams provided within the interceptor ditches, meaning attenuation will be applied to overland flows, which did not exist predevelopment. As the drainage system from the access track and cycle tracks will outfall to the interceptor ditches with check dams. There will be some flood volume storage loss, as the road embankment imposes on the 1% AEP, but hydraulic modelling has determined this will be mitigated by the drop in the pre-development 1% AEP flood extents, which is a consequence of replacing undersized culverts.	Imperceptible
Pluck	39_2506	**Medium**: Residential properties and Water works were identified approximately 200 meters upstream of culvert S3-CUL.04. Potentially fish bearing though currently with poor water quality.	The proposed N14 road embankment, the proposed cycle track and AR3.03 access track all impose on the 1% AEP Flood extent in the vicinity of this stream. Surface water from access track and the cycle way will outfall to this stream. This stream is culverted by S3-CUL.04 and S3-CUL.05.	**Negligible:** Attenuation will be provided so that mainline flows to the stream are reduced to greenfield rate. Check dams provided within interceptor ditches, meaning attenuation will be applied to overland flows, which did not exist predevelopment. As the drainage system from the access track and cycle tracks will outfall to the interceptor ditches with check dams. There will be some flood volume storage loss, as the road embankment imposes on the 1% AEP, but hydraulic modelling has determined this will be mitigated by the drop in the pre-development 1% AEP flood extents, which is a consequence of replacing undersized culverts.	Imperceptible

EPA River Name	Watercourse Segment Code	Hydrological Importance Rating (TII Guidelines)	Proposed Development	Magnitude of Impact (TII Guidelines)	Significance of Effect (EPA (2022)
Pluck	39_431	**Medium:** Upstream residential properties were identified as been at risk. Potentially fish bearing though currently with poor water quality.	The existing stream is culverted along the section affected by the proposed N14 road embankment by Culvert S3-CUL.06. There are some interceptor drains containing overland flow and cycle track runoff which will outfall to this stream, but attenuation will be provided within the interceptor ditches via check dams.	**Negligible:** Hydraulic modelling and CFRAM mapping indicated that upstream properties were already within the 1% AEP flood zone. Hydraulic modelling was conducted and Culvert S3-CUL.06 was sized so that the observed upstream flooding would not be made worse by the provision of the culvert. No mainline or sideroad road runoff is proposed to discharge this stream.	Imperceptible
Pluck	39_458	**Low:** No residential or commercial properties located in the vicinity. Potentially fish bearing though currently with poor water quality (Q3).	The existing stream will be culverted along the section affected by the N14 road embankment (Culvert S3-CUL.07). The stream will be diverted locally upstream and downstream by the W3-04 Watercourse diversion. Some interceptor drains containing sideroad flows and overland flow will outfall to this stream.	**Negligible**: Stream segment is not identified as at flood risk. Road runoff from the mainline discharged to the stream will be attenuated via Attenuation Pond 03 (Outfall 04). Interceptor drain flows to the stream will be attenuated via check dams. The Northern section of the realigned L1274 Drumoghill Link will outfall to this stream, but the pre and post development flows will be similar, and the post development flows be attenuated via interceptor ditch and check dams.	Imperceptible
Drumoghill (39_2535), Drumoghill (39_208) and Drumcarn (39_209)	As listed	**Low:** No residential or commercial properties located in the vicinity. Low quality drain with poor water quality and no fisheries potential.	The 39_208 and 39_208 will be diverted via Watercourse Diversion W3-05: 39_208 will be culverted by S3-CUL.08 beneath Drumoghill Sideroad(L1274). 39_208 will be culverted beneath the proposed N14 Mainline embankment by culvert S3-CUL.09. 39_2535 will be culverted beneath the Drumoghill sideroad (L1274) by culvert S3-CUL.10 and beneath access track AR 3.12 by S3-CUL.11. Attenuation from the N14 Mainline will be provided by Attenuation Pond 04 (Outfall 05), and from Drumoghill Sideroad (LX 3014), via Attenuation Pond 18 (Also Outfall 05).	**Negligible**: stream segment is not identified as at flood risk. Road runoff from the mainline and Drumoghill sideroad discharged to the stream will be attenuated via Attenuation Ponds 04 and 18 (Outfall 05). Interceptor drain flows to the stream will be attenuated via Check Dams.	Imperceptible

EPA River Name	Watercourse Segment Code	Hydrological Importance Rating (TII Guidelines)	Proposed Development	Magnitude of Impact (TII Guidelines)	Significance of Effect (EPA (2022)
Doorable	39_525	**Low**: No residential or commercial properties at risk in the vicinity. This onsite assessment classified this as a ditch which has limited potential to support fish with poor water quality.	The subject stream is to be diverted for approximately 250 m by Watercourse Diversion W3-07. It will be culverted beneath the proposed N14 Mainline and the existing N14 (To be reclassified as the LX 3014) by culverts S3-CUL.12. Attenuation provided by Ponds 05 and 19, which will attenuate flows from the N14 and the old N14 (Reclassified as the LX 3014) respectively. Minor access tracks and overland flow will be attenuated by the interceptor drain system which will include check dams.	**Negligible**: stream segment is not identified as at flood risk. Road runoff will be attenuated with no increase in flood risk. Furthermore, the proposed culverts have been adequately sized to avoid any flood risk in its upstream vicinity.	Imperceptible
Pluck	39_926	**Low**: No residential or commercial properties at risk located in the vicinity. Potentially fish bearing though currently with poor water quality.	The subject stream segment has been culverted under the mainline carriageway at CH4+500 by S3-CUL15, under the existing N14(Renamed the Doorable LX 3014) by S3-CUL.14 and under access road AR3.22 by S3-CUL.13. Minor access tracks and overland flow will be attenuated by the interceptor drain system which will include check dams. Attenuation from the N14 Mainline will be provided by Attenuation Ponds 05 and 06 (Outfall 05).	**Negligible**: stream segment is not identified as at flood risk. Road runoff will be attenuated with no increase in flood volume over baseline. Furthermore, the proposed culvert has been adequately sized to avoid any flood risk in its upstream vicinity.	Imperceptible
Galdonagh_ Glebe	39_2109	**Low**: No residential or commercial properties at risk are located in the vicinity. Low quality drain which currently has no fisheries potential.	This stream segment is to be culverted underneath the proposed N14 by S3-CUL.17. Watercourse Diversion W3-09 will divert the stream locally. The mainline drainage will be attenuated in the region. The existing N14 (to be renamed Local road LX 3014 Sheshkinpoll) will be realigned and provided with a modern drainage system which includes attenuation.	**Negligible:** stream segment is not identified as at flood risk. Road runoff will be attenuated to the predevelopment stage, therefore there will be no increase in flood volume. Furthermore, the proposed culvert has been adequately sized to avoid any flood risk in its upstream vicinity.	Imperceptible

EPA River Name	Watercourse Segment Code	Hydrological Importance Rating (TII Guidelines)	Proposed Development	Magnitude of Impact (TII Guidelines)	Significance of Effect (EPA (2022)
Skeskinapoll	01_384	**Low**: No residential or commercial properties at risk located in the vicinity. Upper reaches are a low-quality drain with poor water quality and no fisheries potential.	This stream segment is to be culverted underneath the proposed N14 by S3-CUL.18 at Chainage 6+550. Culvert S3-CUL.19 divert the stream beneath the existing N14 (to be renamed Sheskinnapoll Local road. Watercourse diversion W3-10 will divert the stream locally at the headwalls only. The mainline drainage will be attenuated in the region. The existing N14 (to be renamed Local Road LX 3014 Sheshkinpoll) will be realigned and provided with a modern drainage system which includes attenuation.	**Negligible**: stream segment is not identified as at flood risk. Road runoff will be attenuated to the predevelopment stage, therefore there will be no increase in flood volume. Furthermore, the proposed culvert has been adequately sized to avoid any flood risk in its upstream vicinity.	Imperceptible
Drumbeg	01_292	**Low**: No residential or commercial properties at risk are in the vicinity. Potentially fish bearing though currently with poor water quality.	The stream segment is to be culverted beneath access road AR 3.32 by S3-CUL.21, beneath the proposed N14 mainline by S3-CUL.22 and beneath the old N14 (Realigned and renamed the R2236 LX 3014 Link South) by S3-CUL.23. Watercourse Diversion W3-12A will connect these culverts, but it's route will follow same route as the existing stream. The mainline and a portion of the existing N14 (Realigned and renamed the R2236 LX 3014 Link South) will be attenuated in this region.	**Negligible**: stream segment is not identified as at flood risk. Road runoff will be attenuated to the predevelopment stage, therefore there will be no increase in flood risk. Furthermore, the proposed culvert has been adequately sized to avoid any flood risk in its upstream vicinity.	Imperceptible
Sheskinnapoll	01_385	**Medium**: No residential or commercial properties located in the vicinity. Potentially fish bearing though currently with poor water quality.	The stream will be culverted beneath the proposed N14 via Culvert S3-CUL-20 at Chainage 7+400. and diverted to the West of the mainline via Watercourse Diversion W3-11.	**Small Adverse:** slight increase in flood level in the vicinity (upstream and downstream) of the proposed culvert crossings. Any flood volume storage loss likely to be caused by road embankment encroachment was found to be minimal.	Slight
Drumbeg	01_191, 01_292, 01_293, 01_1114 and 01_1332	**Medium**: Residential properties are in the vicinity. Potentially fish bearing	Stream sections 01_292, 01_293 and 01_1332 are to be diverted by a watercourse diversion between chainage 9+200 and 10+200 RHS.	**Minor Beneficial:** The CFRAM mapping indicated that this section of stream was previously susceptible to flooding. By diverting the stream along a watercourse diversion	Neutral to Slight Positive

EPA River Name	Watercourse Segment Code	Hydrological Importance Rating (TII Guidelines)	Proposed Development	Magnitude of Impact (TII Guidelines)	Significance of Effect (EPA (2022)
		though currently with poor water quality.	Culverted at Chainage 9+200 by culvert S3-CUL.25 and under the N14 Mainline at Chainage 10+400. Streams 01_291 and 01_1114 will be diverted to the North of the mainline and the flows diverted beneath the existing N14 (Renamed LX 3014 Tullyrap) by culvert S3-CUL.25 and beneath proposed mainline by S3-CUL.26.	which has more capacity than the existing stream, the flood risk is reduced.	
Swilly Burn	01_1852, 01_1503,01_320 and 01_464	**High**: Significant river, with existing flood embankments each side. Water levels are tidally influenced in the proposed crossing reach. Migration route and holding for salmonids.	The river is to be clear spanned by a 25 m Single Span Bridge. The abutments will be within the flat area between the existing embankments each side of the river.	**Negligible**: The bridge is sized adequately to ensure there are no significant effects to the water levels upstream and downstream.	Imperceptible
Deele River	01_1541, 01_1548 and 01_1560	**Very High**: County Importance – salmonid holding and migration route. Has a tendency to flood. The village of Ballindrait is located upstream of the proposed crossing point. Water levels are tidally influenced in the proposed crossing reach.	At Chainage 14+400, a Three Span Bridge is to be provided. The Central Span will be 54 m, with the side spans having spans of 20 m each. In addition, there will be four flood alleviation culverts located to the northwest of the bridge crossing.	**Negligible:** The bridge and flood culverts are sized adequately to ensure there are no significant effects to the water levels upstream and downstream.	Imperceptible
River Finn	01_7109	**Extremely High:** River Finn SAC - of International Importance. Records of flooding along the channel. Urban Lifford / Strabane immediately downstream.	A link bridge across the River Finn (The A5 Link), is to be provided at Section 3's Terminus. The Lifford Junction (chainage 17+540). The link bridge is an eight-span bridge	**Negligible**: The bridge and flood culverts are sized adequately to ensure there are no significant effects to the water levels upstream and downstream. Note that the hydraulic modelling considered effects of the Proposed Development cumulatively with the proposed A5 WTC Project (Western Transport Project).	Imperceptible

11.8.4.3 Impact on WFD Status and Hydromorphology

The WFD Compliance Evaluation set out in Appendix C11.04 provides the description of impact (if any) on Article 4(1) objective status of waterbodies with regards to supporting hydromorphological quality elements as defined in Annex V of the Directive. The Proposed Development, by design and with mitigations implemented as prescribed in Chapter 9B: Biodiversity – Aquatic and Section 11.9 (below) will not cause deterioration of status in any water body, nor will it prevent the achievement of good status, which is in line with WFD Article 4(1) objectives.

11.8.4.4 Project Wide Operation Phase Impacts

- There is no potential for direct or indirect significant negative project wide effects on water quality in the operation phase. This is demonstrated in the HEWRAT assessment results as set out above
- There is potential for permanent significant negative effects on flood risk in the operation phase at the following locations:
    - Section; 1 Burn Daurnett River at Dooish Junction, N15 tie-in and N13 northern tie-in.
    - Section 2; Lough Swilly floodplain at Bonagee Junction.

  This is addressed through provision of flood compensation storage areas as outlined in mitigation Section 11.10.2.

11.9 Best Practice and Design Measures

11.9.1 Construction Phase Best Practice Measures

The following Best Practice Guidelines will be applied during the construction phase. An examination of the Proposed Development's compliance with the guidelines through design has been made.

1. **Guidelines for Fisheries Protection during Development Works (Foyle and Carlingford areas) (Loughs Agency,2011)**

   Relevance: These guidelines provide best practice standards for:
   - Design and construction of river crossings (e.g., bridges and culverts)
   - Pollution prevention and runoff management
   - Timing and execution of in-stream works
   - Protection of aquatic and riparian habitats
   - Legal obligations under fisheries legislation

   Compliance: The proposed drainage and construction design complies with the above guidelines through:
   - Use of clear-span bridges and appropriately designed culverts to maintain fish passage.
   - Integration of sediment control measures such as settlement ponds and buffer zones.
   - Scheduling of in-stream works between May and September to avoid sensitive spawning periods.
   - Implementation of bunded storage for fuels and chemicals, and dry working conditions for concrete operations.
   - Construction method statements for in-stream works will be submitted to the Loughs Agency. Refer to Chapter 9B: Biodiversity (Aquatic Ecology) for detail of Section 47 and 70 permits.

2. **Guidelines for the crossing of Watercourses During Construction of National Road Schemes (NRA, 2008)**

Relevance: These guidelines provide best practice standards for:

- Design of bridges and culverts to maintain natural flow regimes and avoid obstruction of fish and mammal passage.
- Flood management considerations, including:
  - Culvert sizing and placement to accommodate flood flows.
  - Avoidance of raised aprons and poor channel modifications that could impede flow or increase flood risk.
  - Embedment of box culverts on fish bearing streams to 500 mm below existing bed level.
  - Reprofiling of watercourses to retain low-flow channels and create stepped flood channels for increased conveyance capacity.
- Maintenance protocols that ensure flood conveyance is preserved while protecting ecological integrity.
- Pollution prevention and sediment control measures to avoid degradation of water quality during construction.

Compliance: The proposed drainage and construction design complies with the above guidelines through:

- Hydraulic design of culverts, bridges and stream diversions according to OPW Section 50 and Section 9 requirements.
- Allowance in the hydraulic design for 500 mm embedment of box culverts on fish bearing streams.
- Designing permanent drainage systems to intercept and treat runoff before discharge.
- Implementing sediment control measures such as silt fences, temporary and permanent attenuation ponds, and buffer zones.

3. **CIRIA C648 - Control of water pollution from linear construction projects. Technical guidance. (Murnane et al.,2006)**

Relevance:

- Preventing water pollution throughout the project lifecycle from design to construction and commissioning.
- Managing risks to watercourses from sediment, hydrocarbons, concrete, and other pollutants.
- Supporting compliance with environmental legislation and regulatory requirements.
- Providing best practice procedures for pollution control, including temporary drainage, containment, and emergency response.

Compliance: The proposed drainage and construction design complies with the above guidelines through:

- Designing site drainage systems to intercept and treat runoff before discharge.
- Implementing sediment control measures such as silt fences, lagoons, and buffer zones.
- Using bunded areas for fuel and chemical storage, with spill kits and emergency protocols.
- Conducting environmental risk assessments and integrating pollution prevention into the Environmental Operating Plan (EOP).
- Training site personnel on pollution risks and response procedures.
- Monitoring and maintaining pollution control infrastructure throughout construction.

Key measures to control and treat silt-contaminated run off from the site during construction, incorporated into the Construction Methodology (Section 4.12.6 of Chapter 4: Project Description) are as follows:

- Early installation of Pre-Earthworks Drainage (PED) will occur to separate 'clean' catchment runoff from construction areas.
- Interception, channelling and/or discharge of surface water from sumps, excavations and exposed soil surfaces to silt traps and settlement ponds.
- Construction of silt traps, silt fences, settlement lagoons / ponds (e.g., permanent ponds to be used as temporary settlement ponds during construction) at an early stage in the construction programme.
- Construction of cut-off ditches to prevent surface water run-off from entering excavations.
- Temporary access/ haul routes to be surfaced by granular materials to prevent erosion of fines and/or rutting by site traffic. Temporary drainage from these shall be managed by cut off drains, check dams and interceptor channels that direct runoff to temporary settlement ponds.
- Storage of fuel, oils and chemicals on an impermeable base, away from drains and watercourses. Fuel storage areas should be bunded to provide adequate retention capacity in the event of a leak or spillage occurring.
- Refuelling of plant and vehicles on impermeable surfaces, away from drains and watercourses provision of spill kits at high risk and/or sensitive sites.
- Installation of wheel wash and plant washing facilities having no overflow where effluents are retained pending treatment and disposal.
- Implementation of measures to minimise waste and ensure correct handling, storage and disposal of waste (most notably wet concrete and asphalt).

11.9.2 Operational Phase Best Practice Measures

Water Quality

Operational phase impacts on water quality are mitigated by design through the following measures:

- All attenuation ponds will be lined. Attenuation ponds are designed as hybrid wetlands, so they provide both an attenuation and a water treatment function. The ponds will be planted with appropriate native species suitable for the specific zone of the pond including permanently wet, marginal zones and dry earthworks slopes. Ponds will be inspected and maintained to ensure their integrity and treatment function according to TII drainage standards.
- Rock armour at the inlets/outlets of all culverts will reduce any risk of scouring in the channel beds.
- Sustainable road drainage systems such as filter drains, and grass surface water channels have been designed into the project where feasible. However, in areas with high groundwater vulnerability, sealed drainage systems including concrete channels or plastic pipes have been prescribed to prevent infiltration into the ground.

  The type of drainage collection system (e.g., concrete channels, filter drains, grass channels) has been determined based on the outcomes of the HEWRAT assessment and geotechnical requirements.

  - Sealed systems (concrete or plastic) will be used where protection of groundwater is necessary.
  - Unsealed systems will be porous, allowing clean water to filter into the ground.
  - Filter drains will be installed adjacent to unsealed systems to collect clean runoff from cut slopes.

Flood Risk

The following best practice measures are included in the design to avoid potential flood impacts:

- Attenuation ponds are designed to cater for storm water runoff up to and including the 1 in 100-year return period storm event with a 20% increase in flows to cater for the effects of climate change. An additional 300 mm freeboard is included at all attenuation facilities. An overflow discharge facility will be provided for storms in excess of the freeboard level. Where attenuation ponds are located in areas liable to flooding, e.g., river or estuary floodplains, ponds will be designed for a 1 in 100-year return

period and an assessment of the impact of the pond on the hydraulic regime of the watercourse is undertaken and the pond bunded to a level 500 mm above the adjacent 1 in 100-year flood level. Flood compensatory measures are provided where the provision of the attenuation pond reduces the area available to flood in the current scenario.

- At all crossings, encroachments within the watercourse floodplains have been minimised such that any increase in flood levels in the upstream or downstream vicinity due to flood volume storage loss have been assessed as minimal.
- All bridge/culverts are sized for 1% AEP design flows such that net head losses are less than the OPW section 50 Guidelines specified head loss of 300 mm in all cases, and the available freeboards above the design flood levels are greater than the OPW section 50 Guidelines specified freeboard of 300 mm in all cases.

11.10 Mitigation Measures

11.10.1 Construction Phase Mitigation Measures

An Environmental Clerk of Works (ECoW) will be appointed to ensure the implementation or mitigation and monitoring measures during the construction of the Proposed Development. The ECoW will be appointed prior to the commencement of any construction or enabling works. The ECoW will be responsible for and oversee the contractor's environmental management of the construction works.

The Applicant will ensure that the contract(s) for the construction of the Proposed Development allow for the regular checking of mitigation measures, monitoring and other environmental commitments, the cessation of construction works at any locations where these are not operating as planned, and the undertaking of corrective actions.

Construction Phase Water Quality Protection Measures

All construction phase mitigation measures set out in Chapter 9B: Biodiversity – Aquatic, Section 9B.6 and Appendix C9B.04 relating to protection of water quality for aquatic biodiversity shall be adhered to.

- To protect sensitive surface waters during the construction phase, i.e., at the crossing of SAC channels, temporary cofferdams are proposed for the construction of the bridge piers for the River Swilly and River Finn crossings. These will enclose each of the individual pier foundation works that are located on the floodplain (northern bank) of the River Finn in Section 1 and of the floodplain (western bank) of the River Swilly in Section 2. The function of the cofferdams is to contain the temporary works areas: preventing uncontrolled suspended solids escapement and excluding potential floodwaters during the construction of bridge pier foundations. Cofferdam walls are made of impermeable, interlocking steel sheet piles. The sheet piles are to be installed using a hydraulic press method, which is feasible considering the stiff /dense subsoils with pre-auguring as necessary, to form a continuous interlocking vertical wall. The top of the sheet piles will extend to a height above the ground surface which is above the peak 1% AEP (plus 20% CCA), plus a minimum of 200 mm freeboard.

- Groundwater ingress to a cofferdam will either be through the floor of the cofferdam or from the interlock between piles, though properly constructed and maintained sheet piles will allow very little water ingress at the interlock. The majority of water ingress will be through the floor of the cofferdam. The water accumulating in the cofferdams will be pumped from a sump formed in the cofferdam to a storage bowser positioned outside of the cofferdam. The pump-out water is likely to be turbid as well as highly alkaline (concrete washings) and potentially contaminated with hydrocarbons (polycyclic aromatic hydrocarbons (PAHs), oils).

- Pump-out water from these areas shall be transported to the nearest permanent attenuation pond and shall be subject to the monitoring and treatment protocol set out in Section 11.12.1 of this Chapter.

The implementation of environmental control measures to protect watercourses from runoff and pollutants will be supervised by a nominated member of the contractor's crew and detailed records will be kept of measures undertaken, their maintenance schedule and any pollution incidents arising.

In addition, a suitably experienced and qualified independent person (Environmental Clerk of Works), will be employed (see Section 11.12, below) to oversee and review of the implementation and operation of the pollution control measures throughout the construction and their records shall be available to the Local Authority, the IFI, Loughs Agency and the NPWS for inspection.

Construction Phase Flood Risk Mitigation

Contractors' works will take account of the flooding threat at the following culvert installations and shall size temporary diversion channel (or allow sufficient pump-over capacity) for their installation to accommodate the Q10 event. Storage of excavated material, plant or construction materials will be located on higher ground away from the watercourses.

- Section 1: Culverts S1-CUL-01, S1-CUL-14, and S1-CUL-28
- Section 2: Culverts S2-CUL-13, S2-CUL-16, S2-CUL-17, S2-CUL-19, S2-CUL-20 and S2-CUL-27
- Section 3: Culverts S3-CUL.01, S3-CUL.02, S3-CUL.03, S3-CUL.04, S3-CUL.05 and S3-CUL.06

Flood compensation areas will be installed at the commencement of the construction works in the areas that have been identified as being at risk of increased flood risk during the operation phase. This relates to the four areas referred in Section 11.8.4.4. This will mitigate predicted moderate/slight and significant effect during construction phase.

11.10.2 Operational Phase Mitigation Measures

To mitigate predicted moderate/slight and significant effects on flood risk, additional flood volume storage has been provided at number of locations. This has been achieved by the inclusion of flood compensation areas. Further details are provided in Appendix C11.01 and Appendix C11.02.

Post-construction, DCC will be responsible for the operational maintenance, monitoring and mitigation measures for the lifetime of the Project.

11.11 Residual Impacts

11.11.1 Construction Phase

With the proposed design, and all mitigation measures and environmental controls implemented as prescribed in the EIAR there will be no significant impact on the water environment arising from the construction phase of the proposed development.

11.11.2 Operational Phase

With the proposed design, and all mitigation measures and environmental controls implemented as prescribed in the EIAR there will be a **positive** impact on the water environment arising from the operational phase of the proposed development. Compared to the existing scenario, the beneficial effect is likely on the water environment into the future because the drainage systems are designed to a higher standard than existing road drainage. Road runoff into the future will be attenuated (and consequently treated) through modern, sustainable drainage features.

There is no significant increase in flood risk predicted during the operational phase of the development, therefore the residual impact is **negligible and not significant**.

11.12 Monitoring

11.12.1 Construction Phase Monitoring of Surface Waters

11.12.1.1 Overview and Responsibilities

A surface water quality monitoring procedure will be followed during the construction works. The aim of this monitoring proposal is to ensure the efficacy of mitigation primarily around sediment loss control. Given the considerable volume of the main receiving rivers (Finn, Deele, Swilly Burn) and the transitional (tidal) nature of the Swilly Estuary, the focus is on monitoring suspended solids emissions from the construction site as it will otherwise be difficult to verify that mixed concentrations within large or tidal waters are related to the construction itself. For aquatic survey site locations referred to in the following monitoring text, see Chapter 9B: Biodiversity – Aquatic.

Environmental Clerk of Works

A suitably qualified technical professional(s) (e.g. Environmental Clerk of Works (ECoW)) will be engaged for the duration of the construction phase. The ECoW(s) shall be based on site and shall oversee the implementation of pollution mitigation measures, compliance with environmental planning conditions, monitoring and reporting on environmental aspects of the development, and liaison with third parties and the Planning Authority. The ECoW appointment and role will cover all phases of the construction including advance works and accommodation works.

- The ECoW is responsible for all monitoring duties and shall not delegate duties to other staff. The only exception is for unforeseen absence and annual leave cover, in which case the Site Manager shall appoint a suitably qualified back-up ECoW to temporarily fulfil the role. Training for each member of staff on their specific area of responsibility to implement environmental controls shall be carried out before the commencement of that operation. A record of all training carried out shall be maintained in the EOP.

- Toolbox talks on the EOP will be presented by the ECoW to all site staff immediately before works commence. The subject shall be the measures that have been put in place to protect the environment and the procedures, monitoring and recording that is to be undertaken in accordance with the Construction Methodology, environmental commitments and the EOP. Site personnel will be made aware of the ecological sensitivity of the sites and surrounds, i.e., European Sites and Salmonid Water designations.

General Procedures

The following environmental monitoring procedure will be carried out to ensure that environmental protection and management requirements are being implemented and are meeting their objectives:

- Daily visual inspections at active and recently completed construction areas shall be undertaken by the ECoW to ensure mitigation/ control measures (i.e., silt fences, attenuation ponds, drip trays etc). are being implemented and there are no obvious emissions visible, e.g., silt plumes, oil slicks.
- Any maintenance and repairs to mitigation measures shall be carried out immediately by the appointed contractor.
- All environmental monitoring and checklists shall be recorded and added to the EOP on a daily basis.
- The ECoW will report any instances of failure of mitigations, spillage, maintenance and repair by way of specific Incident Reporting sheets that include how the issue was remedied.
- The ECoW will attend all relevant stakeholder meetings (IFI, Loughs Agency, NPWS).

Weather Forecasts

Future seven-day forecasts will be checked daily by the ECoW, with construction works programmed accordingly in the event that heavy rainfall is forecast. Prior to any forecast heavy rainfall, the ECoW will ensure that all sediment loss prevention measures and environmental controls are functioning correctly.

During and immediately after heavy periods of rain, earthmoving activities must be reviewed with temporary restrictions implemented where necessary, e.g., to avoid generation of suspended solids near watercourses.

The following forecasting systems are available and will be used on a daily/weekly basis and reviewed by an EcoW, as required, to allow planning of construction activities with a view to water quality protection:

- General Forecasts: Available from the Met Éireann website (www.met.ie/forecasts) for national, regional and county scales. These provide general information on weather patterns including forecasted rainfall by the hour;
- Atlantic Charts: Available from the Met Éireann website (www.met.ie/forecasts/atlantic-charts/precipitation-pressure) these provide an indication of spread and quantitative rainfall amounts for the next 10 days;
- Weather warnings: Available from the Met Éireann website (www.met.ie/warnings-today.html). Provides advance information on possible occurrence of severe weather;
- Rainfall Radar Images: Available from the Met Éireann website (www.met.ie/latest-reports/recent-rainfall-radar) providing an animation of current rainfall extent and intensity, updated every 15 minutes.

Works involving excavations, earthmoving and instream works will be suspended, and sediment loss control measures will be checked and bolstered, if necessary, in the event of a forecast that suggests an impending high rainfall or high intensity event is likely to occur (based on Mateus and Coogan, 2023):

- >4 mm/hr (high intensity rainfall)
- >25 mm in a 24-hour period (heavy extended rainfall)

11.12.1.2 Surface Water Monitoring Procedure

Monitoring during the construction phase is required to ensure effectiveness of mitigation measures and provide trigger levels for action. The key parameters in relation to potential impacts on aquatic receptors are suspended solids (related to earthworks), pH (related to concrete usage) and oil slicks (related to hydrocarbon usage). In addition to the daily visual inspections of mitigation measures to ensure their correct implementation, water quality monitoring will be undertaken upstream and downstream of construction works at key locations across the proposed development and at key attenuation pond outfalls to watercourses. For aquatic survey site locations referred to in the monitoring text, see Chapter 9B: Biodiversity – Aquatic, and EIAR Drawings 9B.01, 9B.02 and 9B.03 in Volume D: Book of Drawings (Watercourse Survey Locations – Sections 1, 2 and 3).

For any water sampling / analysis prescribed below, the following applies:

- Upstream and downstream water samples shall be collected within a short time of each other on each watercourse to obtain comparable samples.
- Grab samples (water sampling) shall be taken in clean, 1L HDPE bottles and stored in cooler boxes, stored (if required) in a refrigerator; transported within 3 days and analysed by an EPA approved or ISO accredited water analysis laboratory.
- Water sampling shall be conducted such that bed sediment is not disturbed. A long reach pole shall be used on larger rivers to sample the main river flow (as opposed to a backwater).
- Water sampling personnel shall record the following details at each sample site: location (ITM X, Y), watercourse name and sample site code (created by the sampler for easy identification of results), date of sample, time of sample, general flow condition (e.g., flood, high, average, low), estimate of Antecedent Dry Period (ADP); visual observations of turbidity, oil slicks and any other comments relevant to the record of effectiveness of pollution control measures at the site.
- Recording flow condition at the time of sampling is important to the interpretation of results. Elevated flows are when suspended solids are more likely to be mobilised and can be elevated both upstream

and downstream with a wider connectivity to site works. Baseflow conditions (dry periods) would be expected to have low suspended solids levels, hence, a result of elevated TSS during low flow conditions is usually related to localised construction related disturbance which requires immediate action to control the source and pathway of suspended solids generation / loss at the site.

- The ECoW will maintain a regularly updated Excel spreadsheet recording all sample results: daily, weekly and monthly. The spreadsheet will include all relevant information, at a minimum: location, date of sample, time of sample, general flow condition (flood, high, average, low); with columns for recording visual observations, turbidity, pH and suspended solids data. Any actions taken on foot of observations shall also be recorded. This data shall be submitted in Excel format to Donegal County Council on a monthly basis.

- Any differences between upstream and downstream parameter values shall be investigated as to whether the construction is the cause, with remedial action taking place immediately (e.g., temporarily halt works and enhance sediment control measures).

- An excel sheet shall be prepared by the ECoW to tabulate results and rolling averages of upstream / downstream results for total suspended solids (TSS) shall be displayed to view any exceedance of either one-off or mean 25mg/l TSS (Surface freshwater only).

At a minimum, the following monitoring in each proposed road section will be undertaken. Further sampling sites may be identified by IFI or Loughs Agency at the detailed design stage, subject to final construction method statements.

Attenuation Pond Outfalls Monitoring

Suspended solids concentrations in the attenuation pond outfall channels to surface waters shall not exceed 25mg/l TSS or the turbidity (NTU) equivalent and pH shall not exceed 9.0. These are the trigger levels, either separately or together that signal works to stop temporarily to implement additional appropriate control measures following investigation/ evaluation of the source by the ECoW.

Cofferdam Pump-out Water Management

Small amounts of water ingress are expected to seep into the cofferdams surrounding bridge pier foundations in Sections 1, 2 and 3 during their construction. These containment areas will require pumping out to retain dry conditions. Pump-out water is likely to be contaminated with sediment and concrete, and to a lesser extent hydrocarbons. These waters will not be pumped directly to any watercourse or land drain. The contractor will be required to tanker and remove to either an attenuation pond nearby (subject to pH testing, as below), or to a suitably licensed treatment facility.

Pump out water pH testing: Before any concrete pouring has commenced, i.e. in the earth excavation stage, the ECoW will take daily pH readings of a sample of the cofferdam pump-out water to establish a baseline for pH readings (in the absence of concrete). This water can be transported by tanker and discharged into a nearby Attenuation Pond for settlement of suspended solids. However, once bulk liquid concrete pouring has commenced and concrete is curing, the ECoW must conduct daily in situ pH measurement of pump-out water. If pH remains between 6.0 and 9.0, then this water can still be discharged into the Attenuation Ponds for settlement of suspended solids. If pump-out water pH exceeds 9.0, the water will be treated through separate settlement of fine suspended solids (e.g., in a dedicated settlement tank for concrete contaminated pump-out water) to reduce residual pH or transported off-site for disposal at a licenced facility.

11.12.1.3 Specific Monitoring - Section 1

Section 1 is the most sensitive in terms of aquatic ecological receptors, comprising salmonid (including Annex I QI salmon) spawning, nursery and holding habitats. Given the SAC and Salmonid Water designation of the River Finn, it is a requirement that suspended solids limit of 25mg/l average concentration over a period of 12 months, is not breached as a consequence of the construction works. The Burn Daurnett and Cloghroe River, being important salmonid tributaries, shall also be subject to water sampling and analysis.

Table 11-64: Section 1 Site Specific Construction Phase Monitoring

Watercourse	Frequency	Recommended Location(s)	Parameters	Rationale
River Finn (Upstream Ballybofey – related to bridge construction)	**Pre-construction:** fortnightly for 3 months (focusing on elevated flows). **During construction:** once weekly (focusing on elevated flows).	Upstream of W1-06 and 100m downstream confluence of W1-07 tributary.	**Visual inspection; In-situ (hand-held):** turbidity (NTU) pH, conductivity. **Laboratory:** Total suspended solids (mg/l), turbidity (NTU)	River Finn SAC, Salmonid Water (salmonid spawning and nursery habitat)
River Finn (downstream Ballybofey – related to works in Mullaghagarry catchment)	**Pre-construction:** fortnightly for 3 months (focusing on elevated flows). During construction: fortnightly (focusing on elevated flows).	Upstream of W1-20 confluence and at W1-21.	**Visual inspection; In-situ (hand-held):** turbidity (NTU) pH, conductivity. **Laboratory:** Total suspended solids (mg/l), turbidity (NTU)	River Finn SAC, Salmonid Water (salmonid spawning and nursery habitat)
Burn Daurnett	**Pre-construction:** fortnightly for 3 months (focusing on elevated flows). **During construction:** once weekly (focusing on elevated flows).	Upstream of W1-01 tributary confluence and at W1-22	**Visual inspection; In-situ (hand-held):** turbidity (NTU) pH, conductivity. **Laboratory:** Total suspended solids (mg/l), turbidity (NTU)	Spawning tributary of River Finn SAC /Salmonid Water
Cloghroe River	Pre-construction: fortnightly for 3 months (focusing on elevated flows). During construction: once weekly (focusing on elevated flows).	Upstream of W1-14 and 100m downstream W1-14	**Visual inspection; In-situ (hand-held):** turbidity (NTU) pH, conductivity. **Laboratory:** Total suspended solids (mg/l), turbidity (NTU)	Salmonid spawning tributary of River Deele

In addition, all proposed Attenuation Ponds (plus any additional temporary ponds) shall be subject to daily visual inspection during construction to ensure there are no sediment plumes or oil slick emanating from their discharge to the nearby watercourse / drain.

Attenuation ponds (temporary and/or permanent) discharging directly to the watercourses listed in Table 11-64, shall be subject to periodic sampling , as per Attenuation Pond Outfall Monitoring (above) at their outlets, i.e., River Finn (upstream Ballybofey): Ponds 08, 09, 10, 11; River Finn (downstream Ballybofey) 04, 05 15; Burn Daurnett: Pond 14; Cloghroe: Ponds 01, 21.

'Periodic' is defined as sampling during times a particular pond is discharging, i.e., during rainfall events, Handheld records of turbidity, conductivity and pH shall be taken during periods when these attenuation ponds are hydrologically active (i.e., discharging to the nearby watercourse). The attenuation pond must be blocked off and pollutant sources remedied if pH exceeds 8.5, or if turbidity at the outfall does not represent a decline compared to the inlet value during the same rainfall event.

Grab samples will also be taken at these attenuation pond outfalls when they are active. This must capture the first 6 no. rainfall events after construction commences, and shall include at least 3 samples per discharge event, capturing early, mid and later stages of the event. If rain (and therefore pond discharge) persists for multiple days, sampling shall be conducted daily throughout the event. In addition, there shall be continued (minimum weekly) sampling during subsequent hydrological activity (i.e., during rainfall). These attenuation pond outfall samples shall be analysed for suspended solids (mg/l) and turbidity (NTU) to establish a broad correlation between the two parameters (reliable correlation involves a minimum of 30 TSS/NTU readings). If the discharges are shown through grab sampling to be exceeding 25mg/l suspended solids (or the site-specific turbidity equivalent as established by corelation of TSS mg/l and NTU data) then

additional measures, such as additional silt fencing, check dams, and linearly sequenced sediment ponds for silt control must be implemented across the construction site to prevent discharges exceeding 25mg/l TSS.

These attenuation ponds drain to the most sensitive watercourses and act as a proxy for the performance of all ponds across the Section 1 construction areas. Any additional measures required in relation to exceedances identified at the representative ponds shall be implemented at every construction work area across Section 1.

11.12.1.4 Specific Monitoring - Section 2

In Section 2 the main sensitivities are Lough Swilly and tidal River Swilly (W2-18) and Isle Burn (W2-15). Given the tidal and estuarine nature at crossing points W2-18 and W2-15, water sampling will not provide useful construction phase monitoring regarding potential pollutant loss (because tides potentially push in other sources of pollutants, and impound flow which can confounds TSS values, for example). Therefore Section 2 construction phase monitoring will rely heavily on visual observations of watercourses/ waterbodies downstream of attenuation pond outfalls. This includes any temporary ponds and the permanent ponds that are installed to attenuate and settle solids during construction.

This entails the ECoW making daily visual checks and observations for obvious silt plumes, sedimentation, oil slicks either downstream of outfalls (or within the pond itself in the case of oil slicks). This applies particularly during rainfall events when attenuation ponds are hydrologically active.

In addition, a selection of representative Section 2 Attenuation Ponds, including at a minimum Pond 06, 07, 05, 12, 09, 10, shall be subject to periodic sampling at their outlets (in addition to the daily visual inspections). Handheld records of turbidity (NTU), conductivity and pH shall be taken during periods when these attenuation ponds are hydrologically active (i.e., discharging to the nearby watercourse). The attenuation pond must be blocked off and pollutant sources remedied if pH exceeds 8.5, or if turbidity at the outfall does not represent a decline (of any value) compared to the inlet value during the same rainfall event.

Grab samples will also be taken at these attenuation pond outfalls when they are active. This must capture the first 6 no. rainfall events after construction commences, and shall include at least 3 samples per discharge event, capturing early, mid and later stages of the event. If rain (and therefore pond discharge) persists for multiple days, sampling shall be conducted daily throughout the event. In addition, there shall be continued (minimum weekly) sampling during subsequent hydrological activity (i.e., during rainfall). The attenuation pond outfall samples shall be analysed for suspended solids (mg/l) and turbidity (NTU) to establish a broad correlation between the two parameters (reliable correlation involves a minimum of 30 TSS/NTU readings). If the representative attenuation pond discharges are shown through grab sampling to be exceeding 25mg/l suspended solids (or the site-specific turbidity equivalent as established by corelation of TSS mg/l and NTU data) then additional measures like additional sediment ponds for silt control must be implemented across all Section 2 construction sites to prevent discharges exceeding 25 mg/l TSS.

11.12.1.5 Specific Monitoring - Section 3

In Section 3 the main sensitivities are the River Finn (W3-21), Swilly Burn (W3-14) and River Deele (W3-17). Given the tidal nature at crossing points W2-18 and W2-15, water sampling will not provide useful construction phase monitoring regarding potential pollutant loss (because pushing tides will impound / confound TSS values, for example). Therefore, Section 3 construction phase monitoring will rely heavily on visual observations of watercourses/ waterbodies downstream of attenuation pond outfalls, i.e., permanent attenuation ponds will be installed to act as temporary attenuation ponds during construction.

This entails the ECoW making daily visual checks and observations for obvious silt plumes, sedimentation, oil slicks either downstream of outfalls (or within the pond itself in the case of oil slicks). This applies particularly during rainfall events when attenuation ponds are hydrologically active.

In addition, a selection of representative Section 3 Attenuation Ponds shall be subject to periodic sampling at their outlets. Handheld records of turbidity (NTU), conductivity and pH shall be taken during periods when these attenuation ponds are hydrologically active (i.e., discharging to the nearby watercourse). The attenuation pond must be blocked off and pollutant sources remedied if pH exceeds 8.5, or if turbidity at the outfall does not represent a decline (of any value) compared to the inlet value during the same rainfall event.

Grab samples will also be taken at these attenuation pond outfalls when they are active. This must capture the first 6 no. rainfall events after construction commences, and shall include at least 3 samples per discharge event, capturing early, mid and later stages of the event. If rain (and therefore pond discharge) persists for multiple days, sampling shall be conducted daily throughout the event. In addition, there shall be continued (minimum weekly) sampling during hydrological activity (i.e., during elevated flow condition). The attenuation pond outfall samples shall be analysed for suspended solids (mg/l) and turbidity (NTU) to establish a broad correlation between the two parameters (reliable correlation involves a minimum of 30 TSS/NTU readings). If the representative attenuation pond discharges are shown through grab sampling to be exceeding 25mg/l suspended solids (or the site-specific turbidity equivalent as established by corelation of TSS mg/l and NTU data) then additional measures, e.g., additional sediment ponds in series, for silt control will be implemented to prevent discharges exceeding 25mg/l TSS.

11.12.1.6 Monitoring of Temporary Instream Works Areas

In line with Loughs Agency requirements for water quality protection, all instream works (culvert installation, stream realignments) on fish sensitive watercourses shall be subject to monitoring during the construction phase to ensure instream work activities do not, including in conjunction with any other activities by any other persons:

(a) Raise the waterway downstream to a total suspended solids (TSS) level in excess of 10 milligrams per litre above the upstream level in the mixing zone;

(b) Cause the waterway downstream to contain visible oil or grease;

(c) Cause the waterway downstream to contain any substance (other than as defined above) which will cause the waterway or water in an underground stratum to be toxic or injurious to fish or other aquatic organisms.

Fish sensitive watercourses are those listed in EIAR Appendix 9B. 04 as salmonid (trout, salmon) bearing channels in relation to culvert installations. In addition, the monitoring applies to instream works to construct the stream realignments associated with:

- Bridge construction on the Cloghroe River (Section 1 - N13 northern tie-in: Aquatic survey site W1-14)
- Tullyrap Watercourse Diversion (Section 3 Ch. 9+200 to Ch10+200 on the Drumbeg stream; Aquatic survey sites W3-12, W3-13).

Water quality monitoring will be achieved by taking discrete grab samples on each watercourse in relation to the instream works area involved at two locations:

1. Upstream of the temporary instream works area, and
2. Within 30m downstream, i.e., within the mixing zone, and before any adjoining active drain/stream confluence.

The upstream and downstream samples shall be discrete collected in 1-litre HDPE bottles (provided by laboratory) and clearly labelled. Samples shall be analysed for total suspended solids (mg/l) and turbidity (NTU) at an ISO accredited or EPA approved water analysis laboratory. The frequency of sampling shall be:

- Twice weekly grab sampling on fixed days at each site, e.g., Tuesday & Thursday so as to avoid ‘fair weather sampling’
- Additional grab sampling during at least 3 no. elevated flow (rainfall) events per month at each site. The elevated flow grab samples shall be conducted as close as possible to the peak of the rainfall event as that is when suspended solids are most likely to be mobilised.
- At the time of discrete grab sampling, turbidity measurement in-situ shall also be carried out at the upstream and downstream sites using a hand-held (portable) laboratory calibrated turbidity meter (NTU). These results shall be tabulated and compared to laboratory results and will feed into the establishment of a site-specific correlation between TSS and in-situ turbidity results which can help in the rapid identification of any 10 mg/l TSS exceedance using the portable turbidity probe whilst on site.

Results of discrete water sampling (TSS, turbidity) shall be tabulated by the ECoW within an excel spreadsheet. Any upstream / downstream difference of ≥10 mg/l TSS shall trigger an investigation of the site-specific instream works area to identify the source(s) and pathway(s) of suspended solids losses. Additional measures shall be implemented to manage / reduce sources and further silt control measures (check dams, silt fencing, additional attenuation/settlement areas in sequence) shall be added along the pathways. There will be a delay between the taking of samples and receipt of results at any particular instream works site, however, any ameliorative actions shall be taken as soon as results become available. Any learnings in terms of the types and level of silt control measures required to prevent downstream exceedance of 10 mg/l (or the in-situ turbidity equivalent), within the mixing zone, shall be implemented for each instream works area across the entire proposed development.

To augment discrete water sampling, and to build up a picture of the relationship between TSS concentration (mg/l) and turbidity (NTU), the following shall be conducted at each active instream works site:

- Thrice weekly pH measurement in-situ, using a hand-held (portable) laboratory calibrated pH meter (pH units) - upstream and downstream. pH must remain within the range ≥ 6 ≤ 9. Artificial pH variations shall not exceed ± 0.5 of a pH unit within the limits 6 and 9. If there is a 0.5 pH unit change upstream to downstream, the cause shall be identified (e.g., accidental concrete spillage; leaching or wash out) and measures to secure and remove the source shall be undertaken, such as bunding and removal.
- Thrice weekly turbidity measurement in-situ, using a hand-held (portable) laboratory calibrated turbidity meter (NTU) – Any change in turbidity between upstream and downstream shall trigger an additional round of grab sampling at that time so that a correlation can be made between turbidity (NTU) and TSS (mg/l) to ensure the downstream sample does not exceed 10 mg/l TSS compared to the upstream (control).
- Daily visual observations and records shall be taken of visible turbidity and/or oil slicks or any other form of pollution. A record of any action taken (e.g., bolstering silt control measures) following visual observations shall be kept.

The ECoW will maintain a regularly updated Excel spreadsheet recording all sample results: daily, weekly and monthly. The spreadsheet will include date of sample, time of sample, general flow condition (flood, high, average, low); with columns for recording visual observations, turbidity, pH and suspended solids data. Any actions taken on foot of observations shall also be recorded. This data shall be submitted in Excel format to Donegal County Council on a monthly basis and shall be made available to Loughs Agency and IFI upon request.

11.13 Transboundary Effects

As the main channel of the River Finn/Foyle is on the border between Ireland and Northern Ireland, any impact from the Proposed Development on this river's water quality or flood regime, can be considered to be a transboundary effect as this is a shared waterbody.

The Proposed Development includes the N14/ N15 to A5 Link. The main impact assessment is on the inclusion of the bridge across the River Finn south of Lifford on Section 3 within the Republic of Ireland. As An Coimisiún Pleanála can only consent on projects within the Republic of Ireland, planning for the Proposed Development can only include construction of the N14/N15 to A5 Link to the border of Northern Ireland (NI), with the link ending in the middle of the River Finn. As discussed in Chapter 4, construction of the N14/N15 to A5 Link will only proceed if the proposed Section 1 of the A5 WTC and a proposed Trunk Road T3 in Northern Ireland proceed.

The specialist EIAR chapters have considered the Proposed Development with and without the N14/ N15 to A5 Link. Furthermore, the Proposed Development has assessed cumulative effects with a proposed Trunk Road T3 and the A5 WTC in Northern Ireland. In the scenario where the N14/N15 to A5 Link does not proceed at the time of construction of Section 3, the remainder of Section 3 will be constructed as described in Chapter 4. The roundabout at the N14/N15 Lifford Junction including the active travel elements and the part of the N14/N15 to A5 Link up to approximately chainage 0+080 will be constructed. This small section of road will be blocked-off from the roundabout to prevent traffic from entering. Without the N14/ N15/ A5 Link there is less of a transboundary impact as there will be no construction works taking place over the River Finn, no bridge piers, bridge abutments, and no or very limited construction within the flood zone near the N14/ N15 Lifford Junction roundabout (to facilitate the construction of the roundabout and Active Travel at that location).

11.14 References

CEDR (2018a) D4.1 Literature review on treatment of runoff from highway construction sites. Conference of European Directors of Roads. Available at: https://www.cedr.eu/peb-research-call-2016-water-quality (Accessed December 2025)

CEDR (2018b) Prediction of pollutant loads and concentrations in road run-off. D1.1 - Literature review on road runoff pollution on Europe. Conference of European Directors of Roads. Available at: https://www.cedr.eu/peb-research-call-2016-water-quality (Accessed December 2025)

CIRIA (2019). *Culvert, Screen and Outfall Manual.*

CIRIA (2010). *C689 Culvert Design and Operation Guide.*

CIRIA (2006). *Construction Industry Research and Information Association C648 Control of Water Pollution from Linear Construction Projects*, NBS.

Department of Agriculture, Football and the Marine (2024). *Minimum Specification for Farm Roadways and Underpasses*. Dublin, Gov.ie.

Department of Environment, Heritage and Local Government (2009). T*he Planning System and Flood Risk Management Guidelines for Planning Authorities*, Dublin, Gov.ie.

Department of Housing, Local Government and Heritage (2024). *Water Action Plan: River Basin Management Plan (RMBP) for Ireland 2022-2027*, Dublin, Gov.ie.

Department of Housing, Local Government and Heritage (2014). Circular PL 2/2014 Flooding Guidelines. Dublin, Gov.ie.

Department of Housing, Planning and Local Government (2018). *River Basin Management Plan for Ireland 2018-2021*, Dublin, Gov.ie.

Donegal County Council (2024a). *Donegal County Council - Strategic Flood Risk Assessment (SFRA).*

Donegal County Council (2024b). *Letterkenny Plan & Local Transport Plan 2023-2029.*

Donegal County Council (2018). *County Donegal Development Plan 2018-2024*.

EPA (2024). Update on pressures impacting on water quality – May 2024

EPA (2022). *Guidelines on the information to be contained in Environmental Impact Assessments Reports.*

EPA (2018) WFD Cycle 2 Foyle Catchment Assessment 2010-2015 (HA 01).

EPA (2019). *WFD Characterisation: Assessing Groundwater*, Catchments.ie.

EPA (2020). *Water Quality in 2019 - an indicators report*.

EPA (2016). *Catchments Data Packages*. Available at: https://www.catchments.ie/data/#/?_k=g5br09 [Accessed 2022].

EPA (2006). *Water Quality in Ireland 2005: Key Indicators of the Aquatic Environment.*

European Commission (2017) *Environmental Impact Assessment of Projects, Guidance on the preparation of the Environmental Impact Assessment Report*

Geographic Survey Ireland, (2021). *Open Topographic Data Viewer.* Available at: https://dcenr.maps.arcgis.com/apps/webappviewer/index.html?id=b7c4b0e763964070ad69bf8c1572c9f5 [Accessed 2022].

Geographical Survey Ireland (2020a) *GW Flood Project - Historical Groundwater Flood Mapping.*

Geographical Survey Ireland (2020b) *GW Flood Project - Predictive Groundwater Flood Mapping.*

Highway's Agency (2009). *Highway's Agency Design Manual for Roads and Bridges (HA DMRB),*: National Highway.

Huber, M., Welker, A., Helmreich, B. (2016) Critical review of heavy metal pollution of traffic area runoff: Occurrence, influencing factors, and partitioning. Science of the Total Environment 15 (541): 895-919.

IFI (2016). *Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters*.

Loughs Agency (2011) Guidelines for Fisheries Protection during Development Works (Foyle and Carlingford areas). Environmental Guidelines Series - No. 1

Mateus, C., and Coonan, B. 2023. Estimation of point rainfall frequencies in Ireland. Technical Note No. 68. Met Éireann.

Murnane, E., Heap, A. & Swain, A. (2006). *Control of Water Pollution from Linear Construction Projects,* London.

National Highways, Transport Scotland, Welsh Government and The Department for Infrastructure Northern Ireland (2025). DMRB CG501 Design of highway drainage systems Version 2.2.0 National Parks and Wildlife Services (2017). *Catchment of other extant populations*.

Natural Environment Research Council (1975). *Flood Studies Report*., London, Natural Environment Research Council.

Niven, A. & McCauley, M. (2017). *Foyle Area and Tributaries Catchment Status Report 2016*.

Niven, A. & Rachel, S. (2012). *River Deele and Tributaries Catchment Status Report 2011*, Lough Agency.

NRA (2016). *Design Manual for Roads and Bridges.*

NRA (2015a). *NRA Design Manual for Roads and Bridges (Design of Runoff from Natural Catchments)*.

NRA (2015b). *Design Manual for Roads and Bridges (Road Drainage and the Water Environment)*.

NRA (2008). *Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Roads Schemes*.

NRA (2008). *Guidelines for the Crossing of Watercourses during Construction of National Road Schemes,* Dublin.

Office of Public Works (2021). *Ballybofey-Stranorlar Flood Relief Scheme*. Available at: https://www.floodinfo.ie/frs/en/ballybofey-stranorlar/home/#:~:text=In%20Spring%202021%2C%20Ayesa%20(formerly,communities%20of%20Ballybofey%20and%20Stranorlar. [Accessed November 2025]

Office of Public Works (2020). *Drainage Maps.* Available at: https://www.floodinfo.ie/map/drainage_map/ [Accessed 2025].

Office of Public Works (2020). *Irish Coastal Wave and Water Level Modelling Study 2018*

Office of Public Works (2019). C*limate Change Sectoral Adaptation Plan, Flood Risk Management*.

Office of Public Works (2018). *Flood Risk Management Plan for the North Western River Basin 2018-2021*.

Office of Public Works (2016). *North Western - Neagh Bann Catchment Flood Risk Assessment and Management (CFRAM) Study Unit of Management (UoM) 01 Hydrology Report*.

Office of Public Works (2013). *Irish Coastal Protection Strategy Study Phase 5 - North West Coast*.

Office of Public Works (2012). *The National Preliminary Flood Risk Assessment Overview Report*.

RPS Group (2020). *Irish Coastal Wave and Water Level Modelling Study 2018*.

RPS Group (2017). *North-Western- Neagh Bann CFRAM Study UoM 01 Hydraulics Report*.

RPS Group (2016). *North Western - Neagh Bann CFRAM Study UoM 01 Preliminary Options Report*.

TII (2015a). *Design of Earthworks Drainage, Network Drainage, Attenuation & Pollution Control,* Dublin, TII Publications.

TII (2015b). *Design of Outfall and Culvert Details,* Dublin, TII Publications.

TII, (2015c). *Design of Outlets for Surface Water Channels*, Dublin, TII Publications.

TII (2015d). *Design of Soakaways,* Dublin, TII Publications.

TII (2015e). *Drainage of Runoff from Natural Catchments,* Dublin, TII Publications.

TII (2015f). *Drainage Systems for National Roads,* Dublin, TII Publications.

TII (2015g). *Grassed Surface Water Channels for Road Runoff,* Dublin, TII Publications.

TII (2015h). *Road Drainage and the Water Environment,* Dublin, TII Publications.

TII (2015i). *Spacing of Road Gullies,* Dublin, TII Publication.