BALLINA FLOOD RELIEF SCHEME EIAR

Chapter 12: Water

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12 WATER

12.1 Introduction

This chapter of the Environmental Impact Assessment Report (EIAR) considers and assesses the potential for likely significant impacts of the proposed Ballina Flood Relief Scheme (hereafter referred to as the 'Proposed Scheme') on the natural water environment during both the construction and operational phases. This includes impacts on hydrological regime and water quality. Mitigation and monitoring measures to limit potential significant impacts are set out where appropriate.

A full description of the Proposed Scheme and construction methodology is detailed within **Chapter 5: Project Description**.

Additional impacts relating to the water environment are discussed in other chapters, namely:

- Chapter 7: Population: impact on recreational users of water
- Chapter 9: Aquatic Biodiversity: impacts on aquatic ecology
- Chapter 11: Land, Soil, Geology and Hydrogeology: hydrogeological and groundwater impacts

This chapter should be read in conjunction with the Stage 1 – Appropriate Assessment Screening for the Proposed Scheme, and the Stage 2 – Natura Impact Statement for the Proposed Scheme reports, which have been prepared with reference to European sites; these are available under separate cover as part of the overall application for development consent to An Bord Pleanála (ABP).

12.2 Methodology

12.2.1 Legislation, Policy and Guidance

The following legislative, policy and guidance documents were considered during the preparation of this chapter:

European Union (EU) Legislation

- Directive 2011/92/EU as amended by Directive 2014/52/EU ("the EIA Directive")
- Directive 2007/60/EC ("the Floods Directive")
- Directive 2000/60/EC ("the Water Framework Directive (WFD)")
- Directive 91/271/EEC ("the Urban Waste Water Treatment Directive (UWWTD)")

National Legislation

- S.I. No. 122 of 2014 (EC (Drinking Water) Regulations)
- S.I. No. 489 of 2011 (EC (Technical Specifications for the Chemical Analysis and Monitoring of Water Status) Regulations)
- S.I. No. 9 of 2010, as amended (EC Environmental Objectives (Groundwater) Regulations)
- S.I. No. 272 of 2009, as amended (EC Environmental Objectives (Surface Waters) Regulations)
- S.I. No. 722 of 2003, as amended (EC (Water Policy) Regulations)
- S.I. No. 293 of 1988 (EC (Quality of Salmonid Waters) Regulations)
- Local Government (Water Pollution) Acts 1977, as amended

Policy

- The 2nd cycle River Basin Management Plan (RBMP) (DHLGH, 2018) and The Water Action Plan 2024 A River Basin Management Plan for Ireland (DHLG 2024), which set out the measures necessary to protect and restore water quality in Ireland.
- Mayo County Development Plan 2022-2028 including the SFRA (strategic flood risk assessment) (MCC, 2022).

Guidance

- Climate Change Sectoral Adaptation Plan, Flood Risk Management (OPW, 2019)
- Guidelines on protection of fisheries during construction works in and adjacent to waters (IFI, 2016)

- The Planning System and Flood Risk Assessment Guidelines for the Planning Authorities (DoEHLG, 2009)
- Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes (NRA, 2008)

12.2.2 Zone of Influence

The Zone of Influence (ZoI) consists of a 250m-wide corridor either side of the Proposed Scheme boundary as recommended by the 2008 National Roads Authority (NRA) Guidelines. This is shown in **Figure 12-1**. Consideration is also given to the WFD surface waterbodies that are potentially hydrologically linked to the scheme area.

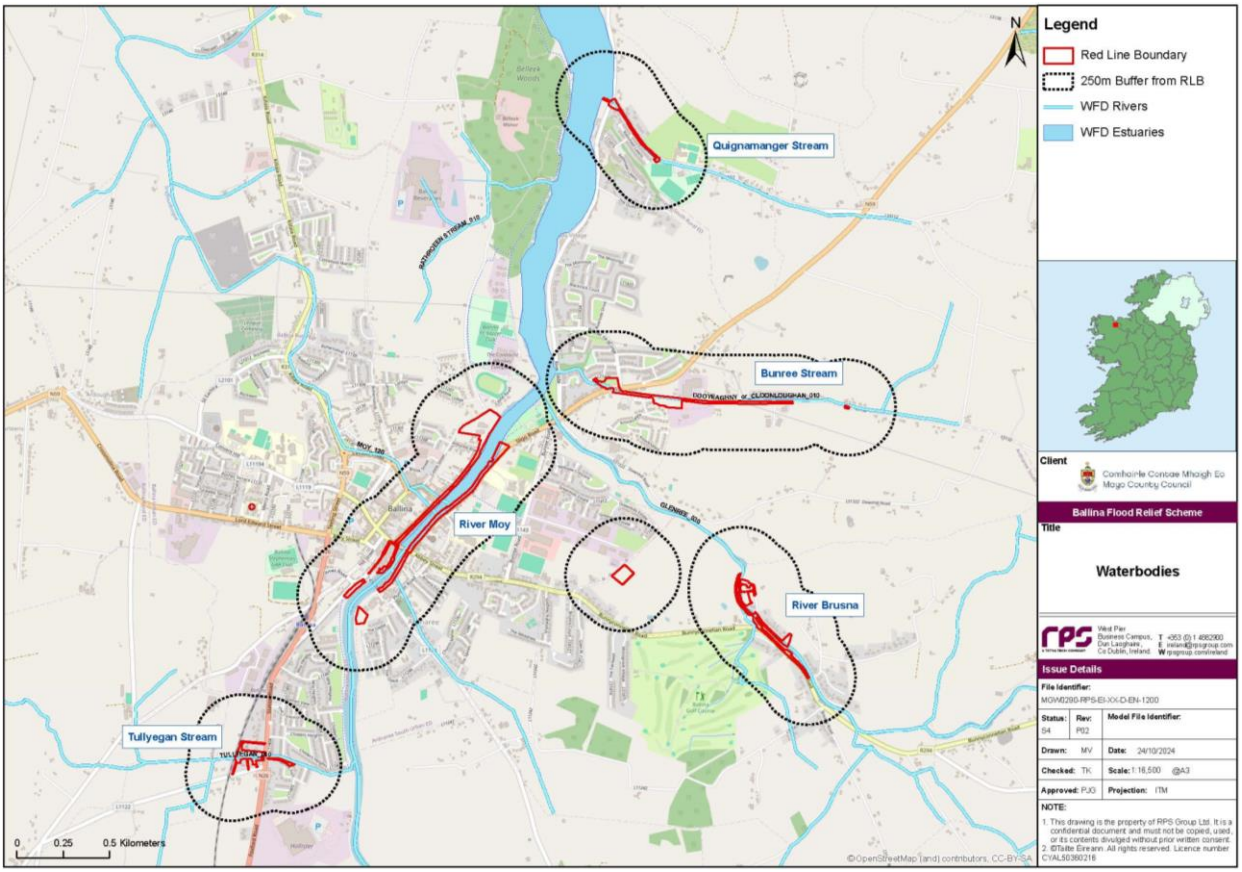

Figure 12-1 Surface Waterbodies within Ballina FRS Study Area

12.2.3 Sources of Information to Inform the Assessment

Information on hydrological receptors within the study area was collected in April 2023 through a detailed desktop review of existing studies and datasets as summarised in **Table 12-1**.

Table 12-1 Summary of Relevant Desktop Reports

Databases	Source
Surface Waters: – Surface watercourses in the study area and their respective water quality status – Water Framework Directive data – Drinking water quality – Environmental Constraints Study	https://gis.epa.ie/EPAMaps/ www.catchments.ie www.water.ie
Flooding:	

Databases	Source
– Office of Public Works (OPW) Flood Hazard Mapping Website – OPW Preliminary Flood Risk Assessment predicted flood maps – OPW Catchment Flood Risk Assessment Management Study predicted flood maps – Ballina FRS Hydrology Report – Ballina FRS Hydraulics Report	www.floodinfo.ie
Teagasc Soil Maps	http://gis.teagasc.ie/soils/map.php
Ordnance Survey Ireland aerial photographs and historical mapping	https://www.osi.ie/
Historic rainfall and evapotranspiration data	www.met.ie
National Parks and Wildlife Services and designated sites	http://webgis.npws.ie/npwsviewer/
Discharge licence reports	www.epa.ie/licensing
Mayo County Development Plan (Mayo CDP) 2022-2028	www.mayo.ie
OPW Hydrological Data	https://waterlevel.ie/hydro-data/

Third party topographic and infill surveys were carried out in 2020 and CCTV surveys in 2021 as part of the scheme. Information was also collected through a number of walkover surveys undertaken by RPS between 2020 and 2023.

- 10/12/2020 – RPS undertook a defence condition survey of the walls along Bachelors Walk.
- 01/07/2021 – RPS undertook a defence condition survey of all defences within the scheme area.
- 23/08/2023 – RPS visited the Ridgepool site and the Quignamanger site to inform design updates in those areas.
- Aquatic Ecology surveys which are detailed in **Chapter 9: Aquatic Biodiversity**.

12.2.4 Key Parameters for Assessment

The following key parameters were examined as those having the potential to result in the greatest hydrological impact on an identified receptor or receptor group:

- Water quality
- Drinking water
- Flood risk
- Hydromorphology

Parameters relating to groundwater and hydrogeology are assessed in **Chapter 11: Land, Soil, Geology & Hydrogeology**. Parameters relating to the recreational use of water are assessed in **Chapter 7: Population**.

12.2.5 Assessment Criteria and Significance

The criteria for determining the significance of effects is a two-stage process that involves defining the sensitivity of the receptors and the magnitude of the predicted impacts.

The importance/sensitivity of hydrology attributes (rating criteria) is defined in accordance with the NRA Guidelines (NRA, 2008), which is the most relevant for assessment of river catchments in Ireland. These are listed in **Table 12-2**.

Table 12-2 Rating Criteria for Importance/Sensitivity of Hydrology Attributes

Importance/ Sensitivity	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 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. Locally important amenity site for wide range of leisure activities.
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.

The magnitude of impact is defined in accordance with the criteria provided in the NRA Guidelines (NRA, 2008) as outlined in **Table 12-3**. These impacts may be positive, neutral, or negative/adverse. The significance of potential impacts are then described in terms of the descriptions adapted from the EPA Guidelines (EPA, 2022) as outlined in

Table 12-4.

Table 12-3 Rating Criteria for the Magnitude of Impact on Hydrology Attributes

Magnitude	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.

Magnitude	Criteria	Typical Examples
Negligible	Results in an impact on attribute but not of sufficient 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.

Table 12-4 Definition of Terms Relating to the Significance of Impact Levels

Significance of Impact	Description
Imperceptible	An impact capable of measurement but without noticeable consequences
Slight	An impact that alters the character of the environment without affecting its sensitivities
Moderate	An impact that alters the character of the environment in a manner that is consistent with existing or emerging trends
Significant	An impact, which by its character, magnitude, duration, or intensity, alters a sensitive aspect of the environment
Profound	An impact which obliterates all previous sensitive characteristics

The significance of the impacts on hydrology attributes is determined by correlating the importance/ sensitivity of the receptor with the magnitude of the impact. The method employed for this assessment is presented in **Table 12-5**. For the purposes of this assessment, any impacts with a significance level of slight or less have been concluded to be not significant in EIA terms.

Table 12-5 Matrix used for the Rating of the Significance of Environmental Impact

		Magnitude of Impact			
		Negligible	**Small**	**Moderate**	**Large**
Importance/ Sensitivity of Attribute	**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

12.2.6 Data Limitations

This chapter of the EIAR has been prepared based upon the best available information and in accordance with current best practice and relevant guidelines. There were no technical difficulties or otherwise encountered in the preparation of this chapter of the EIAR.

12.2.7 Consultations

Meetings and follow up consultations were arranged with stakeholders at all phases of the project. Comments and queries from stakeholders informed design and are addressed throughout this report and summarised in **Table 12-6**.

Table 12-6 List of Consultations Relevant to Water

Consultees	Feedback	Location where Comments were Addressed
Coillte	The Belleek Coillte site is approx. 2 km north of the proposed scheme. It could be impacted if water levels were to rise at this site because of this scheme.	The RPS design team have confirmed that this is highly unlikely and hydrological and hydraulic modelling at detailed design will confirm this (RPS Hydraulics Report (RPS, 2023))
NPWS	• Consider what effect the proposed flood walls and embankments will have on the hydro-morphology of the river channels. • Potential effects on Salmon, Sea Lamprey and Brook Lamprey, such as changes to their habitats, should be considered • Consider the effects of any potential impacts on petrifying springs within the zone of influence.	**Chapter 9: Aquatic Biodiversity** **Chapter 10: Terrestrial Biodiversity** **Chapter 11: Land, Soil, Geology & Hydrogeology**
Transport Infrastructure Ireland (TII)	• A hydraulic analysis should be undertaken to identify the impact of proposed flood alleviation works on the hydraulic capacity of TII Structures, within the scheme study area and the potential for scour at the structures: – TII Structure ID MO-N26-001.00 –Rahan's Bridge N26 – TII Structure ID MO-N59-002.00 –Ballina Lower Bridge N59 – TII Structure ID MO-N59-001.00 –Brusna River Bridge N59 • The potential for scour of the riverbed at bridges may result from increased flows through the bridge. An assessment of scour and other hydraulic actions in accordance with UK BD 97/12 should be undertaken. Scour prevention measures will be required if the assessment illustrates the potential for scour beneath the foundations.	**Section 12.4.2** Scour protection has been added to the Brusna Appendix 9.8 Hydraulic analysis at discrete cross sections in all watercourses
Inland Fisheries Ireland (IFI)	• Strong emphasis given to natural flood management techniques. Schemes should be carried out to enhance natural flood management. • Access to the Moy must remain in place for anglers. • No discharge of silted waters, cement products, hydrocarbons or otherwise polluted waters into any surface watercourse as a result of the proposed works. • Quignamanger: The proposed culvert upgrade must include a replacement culvert which provide passage for any aquatic species present. A significant proportion of the flow within this channel appears to come from a surface water drainage connection approximately 40 m upstream of the Quay road	RPS Options Report (RPS, 2022a) **Chapter 7: Population** and **Section 12.5** **Chapter 5: Project Description**

Consultees	Feedback	Location where Comments were Addressed
	culvert. IFI request that all exiting open channel is retained and existing culverts which restrict flood flows and or fish passage are replaced with adequately designed culverts. All the existing open channel must be retained as open channel. • Brusna: The placement of the proposed embankment and flood wall on the downstream bank should be moved back to allow for maximum connectivity between the river and the adjacent floodplain. All existing riparian trees and vegetation must be retained. • Quignamanger and Brusna: request that all existing open channel is retained as open channel. The channel should be restructured to allow for conveyance or storage of flood flows. • Proposed restrictions on timing of instream works.	**Chapter 5: Project Description** **Chapter 19: Landscape & Visual** **Chapter 5: Project Description** **Chapter 5: Project Description**
Irish Water / Uisce Éireann	• All necessary measures to protect and maintain access to Irish Water infrastructure and water sources shall be undertaken and incorporated into the design.	**Chapter 16: Material Asset – Waste/Utilities**
Member of public	• Need to ensure the project is adapted to climate change.	**Section 12.5**

12.2.8 Hydraulic Modelling

A hydraulic model was developed by RPS which was used to predict the flood extents, out of bank flow paths and water levels in the existing and proposed development scenarios. The model included the River Moy and its main tributaries within the study area. A technical report of the modelling carried out is available in the Ballina Flood Relief Scheme Hydraulic Model Report (RPS, 2023).

12.3 Description of the Existing Environment

This section describes the existing Water environment with respect to hydrology and water quality in the study area and wider catchment.

12.3.1 Baseline Environment

The Proposed Scheme is located in Ballina Town, Co. Mayo, which sits within the lower reaches of the Moy catchment (Hydrometric Area 34). The catchment drains an area of 2,345 km^2, approximately 1,984 km^2 of which is upstream of Ballina Town. The River Moy flows through Ballina Town and discharges into the Atlantic Ocean at Killala Bay 12 km north of Ballina. A number of smaller tributaries are also located within Ballina Town and discharge through built-up areas into the River Moy and the Moy Estuary. Outflows of these tributaries are influenced by the high-water level in the River Moy and Moy Estuary.

Five WFD subcatchments are present within the study area:

- Moy_SC_100 (subcatchment code 34_6), which contains the Tullyegan and Scotchfort tributaries;
- Glenree_SC_010 (subcatchment code 34_9), which contains the Brusna tributary;
- Moy_SC_090 (subcatchment code 34_10), which contains the Ardnaree tributary;
- Leaffony_SC_010 (subcatchment code 34_11), which contains the Bunree and Quignamanger tributaries;
- Abbeytown_SC_010 (subcatchment code 34_19), which contains the Knockanelo, Ardoughan and Quignalecka tributaries.

The individual watercourses are discussed further in the following subsections. An overview of the Moy catchment and the above subcatchments is shown in **Figure 12-2**. Watercourses in the scheme area where no works are scheduled are not assessed. These include the Knockanelo, the Quignalecka/Rathroeen, the Ardnaree, the Ardoughan, and the Scotchfort.

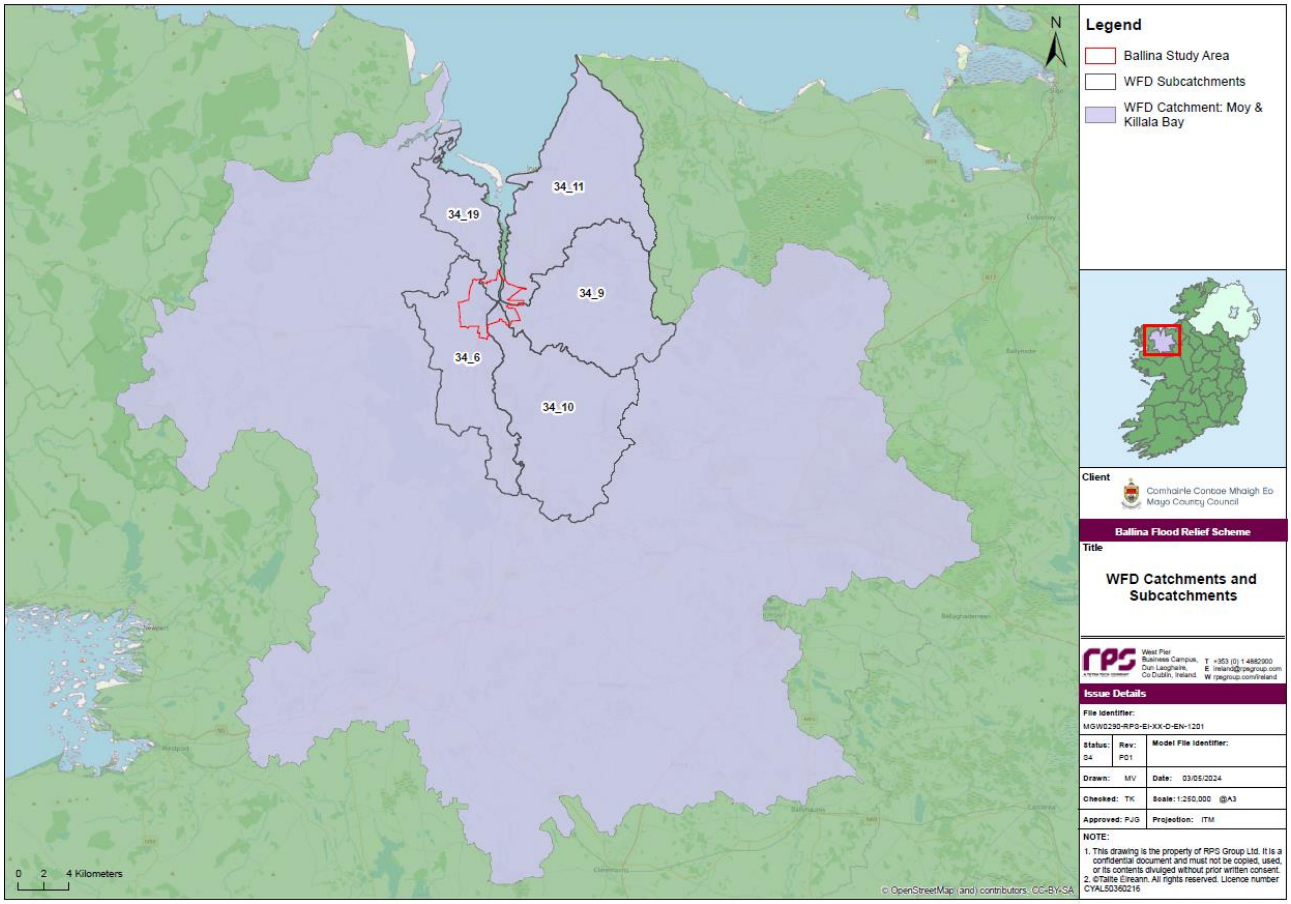

Figure 12-2 WFD Catchments and Subcatchments

12.3.1.1 Flooding

Ballina Town has a long history of flooding from the River Moy, which occurs when the river levels exceed the low point on the river walls, usually at the location of gaps in the walls or from seepage through the walls. Due to its frequent flooding history, Ballina Town and its low-lying environs were identified as an Area for Further Assessment (AFA) under the OPW Preliminary Flood Risk Assessment (PFRA) Study (OPW, 2012). Subsequently, a further detailed assessment was carried out in this AFA under the Western Catchment Flood Risk Assessment and Management (CFRAM) Study (JBA, 2016). A summary of the flood history affecting Ballina is presented in **Table 12-7**.

Table 12-7 Flood History at Ballina and Vicinity

Event Date	Source	Summary of Reports
28th October 2023		Road flooding at Bachelors Walk/Arbuckle Row and Clare Street - no houses impacted.
30th September 2023		Road flooding at Bachelors Walk/Arbuckle Row and Clare Street - no houses impacted.
22nd and 23rd March 2023	Tidal	Flooding occurred along Bachelors Walk and Arbuckle Row to a maximum depth of about 400mm. The flood extents did not impact on any properties.
18th February 2022	Tidal	Road flooding at Bachelors Walk/Arbuckle Row and Clare Street - no houses impacted.

Event Date	Source	Summary of Reports
5th December 2015	Fluvial	During the winter of 2015/2016, Ireland including Moy River catchment experienced exceptional and widespread flooding due to prolonged intense rainfall. The floods of winter 2015/2016 were believed by many to be the worst on record. Water level at Rahans gauge rose to a maximum level of 5.374 mOD on 7th December 2015. In Foxford, flooding to a nursing home from the River Moy occurred as water levels responded to storm events during preceding days. During this flood event, N59 at Cathedral Road and Bachelors Walk in Ballina were flooded; however, no properties were flooded.
3rd Jan 2014	Tidal	Combination of high tide levels and a storm surge resulted in flooding affecting Clare Street, Bachelors Walk, Arbuckle Row and Cathedral Road in Ballina. 10 residential and 3 commercial properties were flooded. One school was also affected by flooding. The road drainage gullies were backed up and could not drain water of the road and so approximately 450 mm of water remained on the road until the tide subsided. N59 national road was flooded for a length of 100 m due to high tides flowing over adjacent sea wall.
26th Nov 2009	Fluvial	Extensive land flooding occurred in the upper Moy catchment (at Foxford, Rahans and Turlough) due to prolonged heavy rainfall.
26th February 1990	Tidal	Flooding on Clare Street, Bachelors Walk, Arbuckle Row) during high tide and storm surge (Tidal water level rose to a level of 3.2 mOD).
30th Oct 1989	Fluvial/Tidal	Extensive flooding in Ballina & Crossmolina. Road and properties in Ballina (Cathedral Road and Bachelors Walk and Arbuckle Row) were flooded. Causes of flooding were the intense rainfall within the Moy catchment coupled with high tide in the River Moy. Boats were used in a “dramatic rescue operation” (Mayo News).
November 1968	Fluvial	Several houses and fire station flooded in Ballina due to prolonged rainfall.
December 1948	Fluvial	Torrential rain caused heavy flooding in County Mayo. In Ballina a few streets were under 2 feet of water.
December 1947	Fluvial	Heavy rainfall in past few weeks led to flooding on south side of Ballina. River Moy burst its banks.
September 1908	Fluvial	Extensive land flooding occurred in Ballina due to heavy rainfall.

There are a total of 297 buildings affected by flooding in the 1% AEP fluvial and 184 buildings in 0.5% AEP coastal flood events within the study area in the present-day scenario. **Figure 12-3** and **Figure 12-4** show the present-day 1% AEP fluvial and 0.5% AEP tidal flood extents within the study area. The target standard of protection of proposed scheme will protect the community against these events. Refer to **Chapter 5: Project Description** for an overview of the receptors at risk from flooding and the proposed SoP.

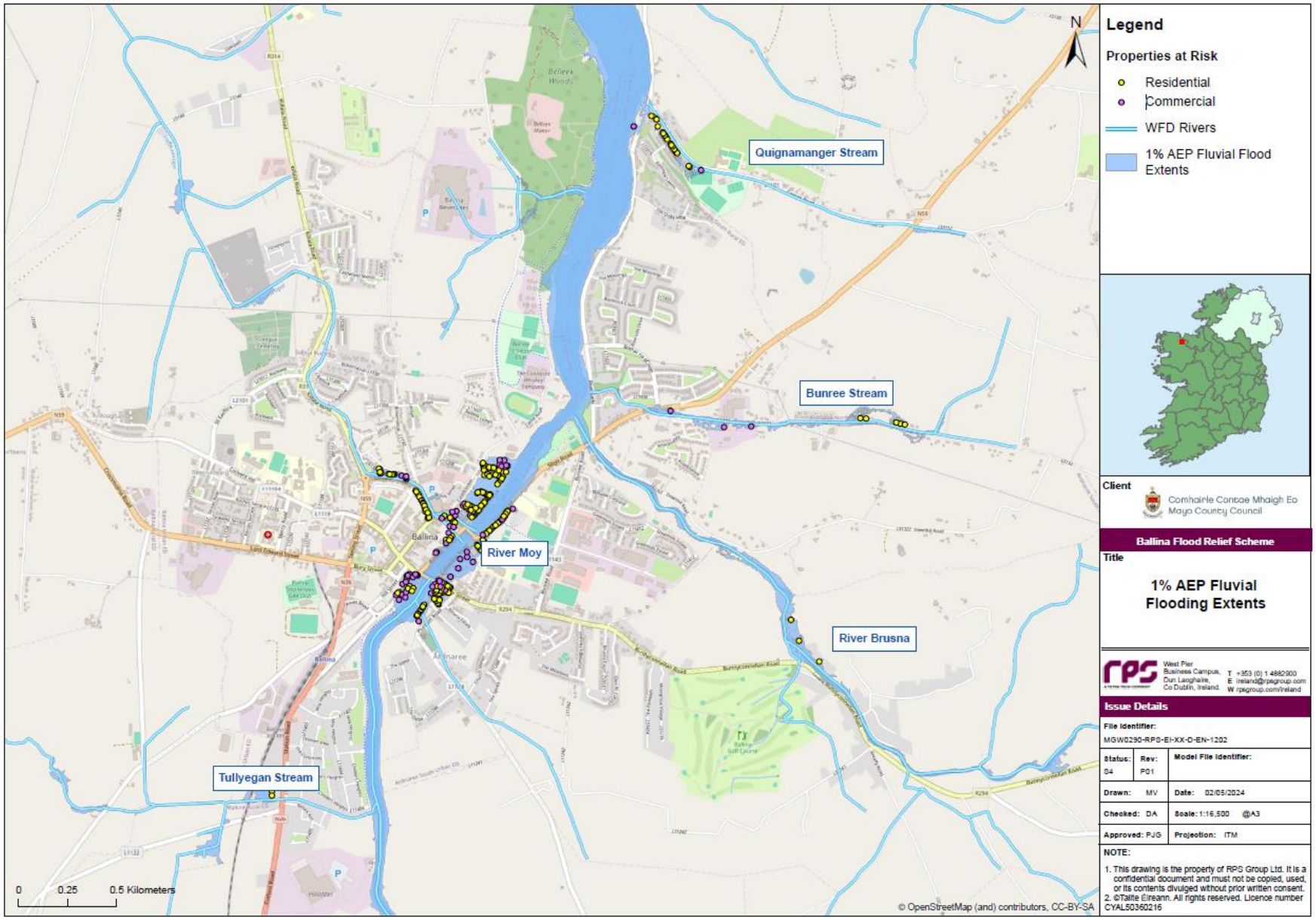

Figure 12-3 Extent Mapping - Baseline Fluvial 1% AEP

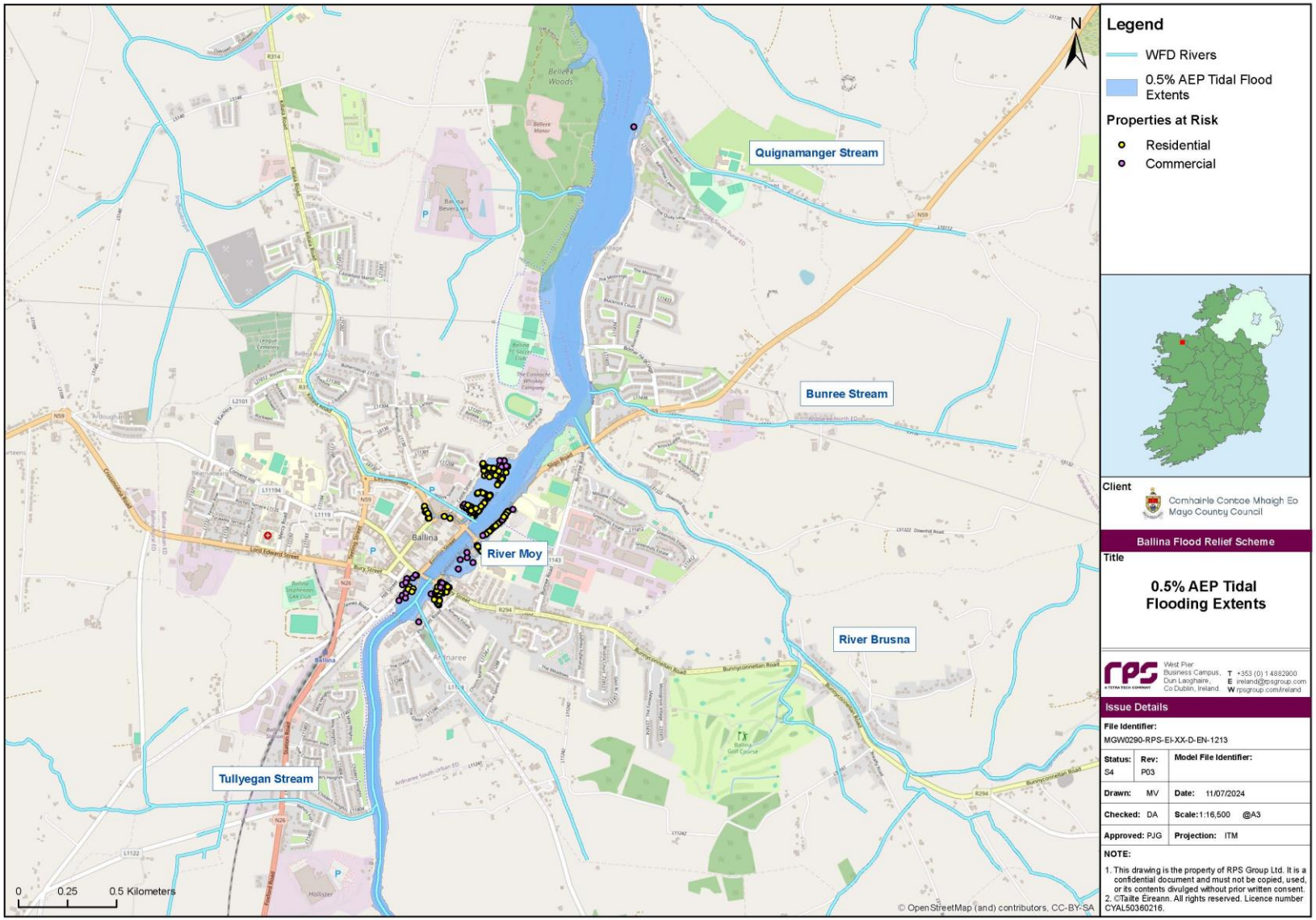

Figure 12-4 Extent Mapping - Baseline Tidal 0.5% AEP

The hydraulic model assessed Ballina as having high sensitivity to climate change. In the 1% AEP fluvial event, an additional 123 buildings are predicted to be affected by flooding in the Mid-Range Future Scenario (MRFS) and an additional 160 buildings in the High-End Future Scenario (HEFS).

The principal watercourses within the study area are discussed in further detail in **Section 12.3.1.7**. The physical catchment descriptors (PCDs) for these watercourses are presented in **Table 12-8**. A map illustrating the location of these watercourses is presented in **Figure 12-1**.

Table 12-8 PCDs for Assessed Watercourses within the Study Area

Watercourse	PCDs									
	AREA (km^2)	DRAIND (km/km^2)	S1085 (m/km)	ARTDRAIN2	FARL	SAAR (mm)	URBEXT	BFISOIL	ALLUV	ARTDRAIN
Moy	1976	1.35	0.73	0.336	0.823	1322.5	0.009	0.776	0.023	0
Brusna/Glenree	95.3	1.96	3.58	0.348	0.994	1190.10	0.0065	0.520	0.019	0.074
Tullyegan	12.4	1.53	2.69	0.882	1.0	1130.97	0.073	0.560	0	0
Bunree	1.9	1.61	10.99	0	1.0	1081.77	0.185	0.595	0	0
Quignamanger	2.2	1.17	13.71	0	1.0	1099.09	0.078	0.598	0	0

The Geological Survey of Ireland (GSI) groundwater flooding probability maps do not indicate a flood risk from groundwater within the study area based on modelling and the underlying geology, and there is no record of historic groundwater flooding within the study area.

The GSI SAR (Synthetic Aperture Radar) seasonal flood maps do indicate localised surface water flooding in greenfield areas between 2015-2021 (low to medium confidence), though some of the areas highlighted are perennial watercourses or ponds – refer to **Figure 12-5**.

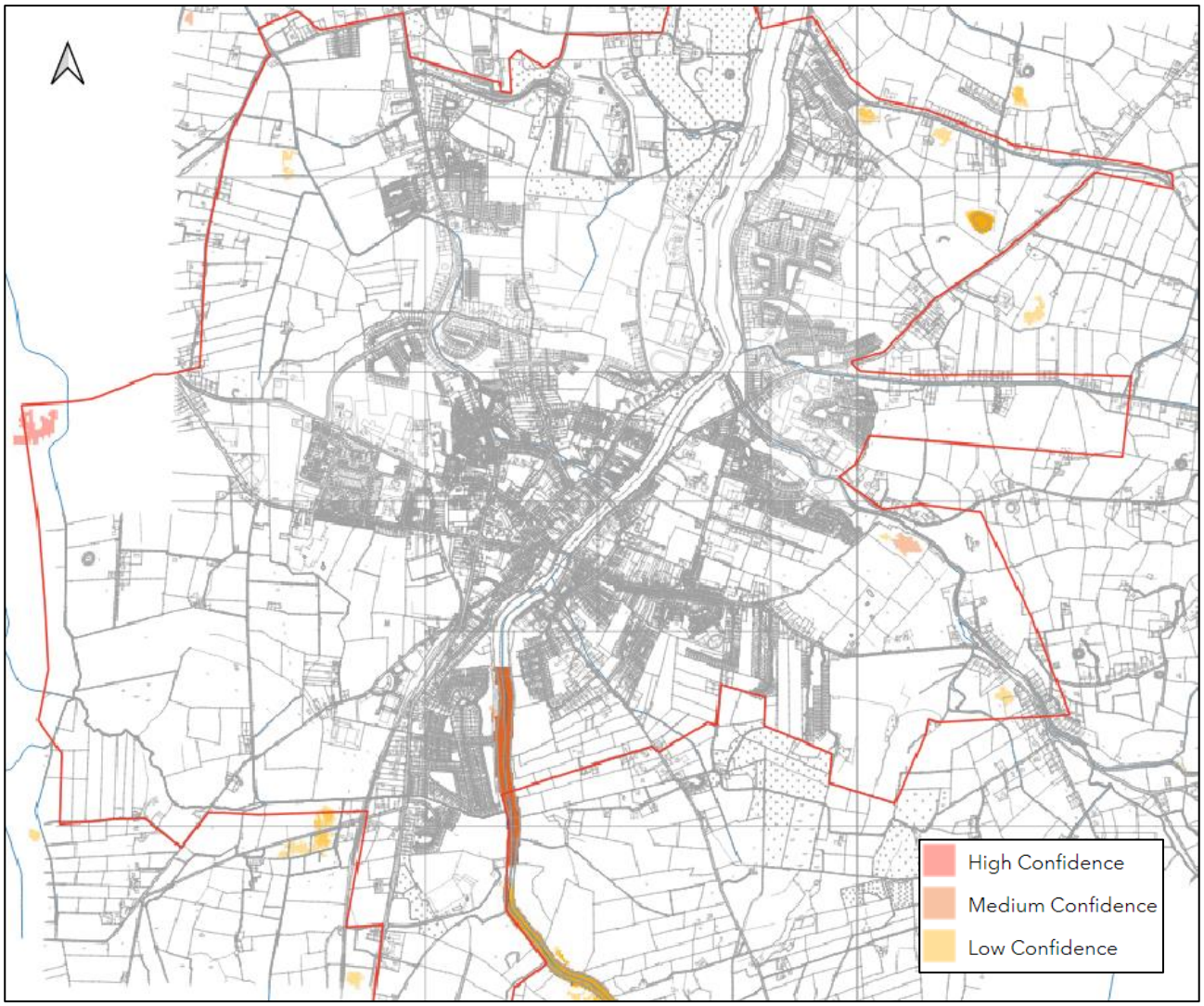

Figure 12-5 GSI Flood Mapping

12.3.1.2 Water Quality

The River Moy is a well-known salmon fishery and is a designated salmonid water. Several water-dependant habitats and species are supported by the Moy Estuary and its tributaries in the vicinity of the town. The Moy Estuary is designated as part of the Killala Bay/ Moy Estuary Special Area of Conservation (SAC)/proposed Natural Heritage Area (pNHA) (Code 000458) and Killala Bay/Moy Estuary Special Protection Area (Code 004036).

The River Moy is designated as part of the River Moy SAC (Code 002298). Enniscrone Beach, downstream in Killala Bay and Ross Beach are Designated Bathing Waters (IEWEBWC420_0000 _0100 and IEWEBWC420_0000_0200). An area within in Killala Bay is a Designated Shellfish Water (IE_WE_420_0000).

The EPA carries out water quality assessments of rivers as part of a nationwide monitoring programme. Data is collected from physicochemical and biological surveys, sampling both river water and the benthic substrate (sediment) in contact with the water. Monitoring data was extracted from available EPA monitoring stations on the River Moy and Brusna to assist with the characterisation of the baseline condition. The data indicate these watercourses are naturally alkaline, have good supporting chemistry conditions and meet the quality standards specified in the Salmonid Regulations.

WFD status is reported by the EPA to the EC as part of six-year reporting cycles. The overall ecological status of the water bodies in the study area are reported by the EPA from the Third Cycle WFD data, which

is based on monitoring data for the six-year period 2013-2018. The latest EPA monitoring data has WFD ecological status for the period 2016-2021. Where water bodies have been classed as being *At Risk*, by water quality or survey data, significant pressures and associated impacts have been identified by the EPA.

The ecological status and risk category of the water bodies within the study area are summarised in **Table 12-9**. The Second Cycle WFD data, based on monitoring data from 2010-2015, is included for reference.

Table 12-9 EPA WFD Status

Water Body	Second WFD Cycle (2010-2015)		Third WFD Cycle (2013-2018)		Third WFD Cycle (2016-2021)	
	Status	Risk	Status	Risk	Status	Risk
Moy Estuary	Moderate	At Risk	Moderate	At Risk	Moderate	At Risk
Moy	Good	Not At Risk	Moderate	At Risk	Moderate	At Risk
Brusna (Glenree)	Good	Not At Risk	Good	Not At Risk	Good	Not At Risk
Tullyegan	Unassigned	Review	Unassigned	Review	Moderate	Review
Bunree	Unassigned	Review	Unassigned	Review	Good	Review
Quignamanger	Unassigned	Review	Unassigned	Review	Good	Review

The classification for biological water quality assigns a Q-value based on the macroinvertebrate community composition. The values are grouped into four classes and the classification for each is detailed in **Chapter 9: Aquatic Biodiversity**. The reported Q-values for the River Moy and River Brusna (Glenree), along with the most recent year of assessment, are presented in **Table 12-10**. Assessments of Q-Values for watercourses not reported by the EPA are contained in **Chapter 9: Aquatic Biodiversity**.

Table 12-10 EPA Q-Values

Watercourse	Station Code	Year	Q-Value	Status
Moy_120	RS34M021040	2007	4	Good
	RS34M021050	2022	3-4	Moderate
Glenree_030	RS34G010100	2022	4-5	High
	RS34G010200	2022	4-5	High

12.3.1.3 Drinking Water Sources

Ballina Town is served by the Ballina Regional Water Supply Scheme. The closest drinking water abstraction point from surface waters is at Lough Conn, c.7 km west of the study area.

There are no known public or private groundwater abstractions within the study area.

12.3.1.4 Arterial Drainage Scheme

Arterial drainage schemes (ADS) provide drainage to low-lying lands to improve land for agriculture and mitigate flooding. Under the Arterial Drainage Acts of 1945 and 1995, the OPW has a legal duty to maintain arterial drainage scheme channels and bridge/culvert structures that form part of those schemes.

The Moy Arterial ADS consists of over 650 channels, with a total length of 1293 km, in the River Moy catchment (JBA, 2021). The scheme involves a range of standard maintenance activities, including in-channel vegetation management, silt removal, bridge/culvert maintenance and tree works. The scheme is reviewed every five years.

Relevant to the watercourses within the study area, there are ADS channels on the River Moy, River Brusna, and Tullyegan stream. There are benefitting lands on the River Moy directly upstream of the salmon weir, on the River Brusna between the golf club and the Twin Trees hotel, and along the full length of the Tullyegan stream. **Figure 12-6** shows the ADS elements in the scheme area.

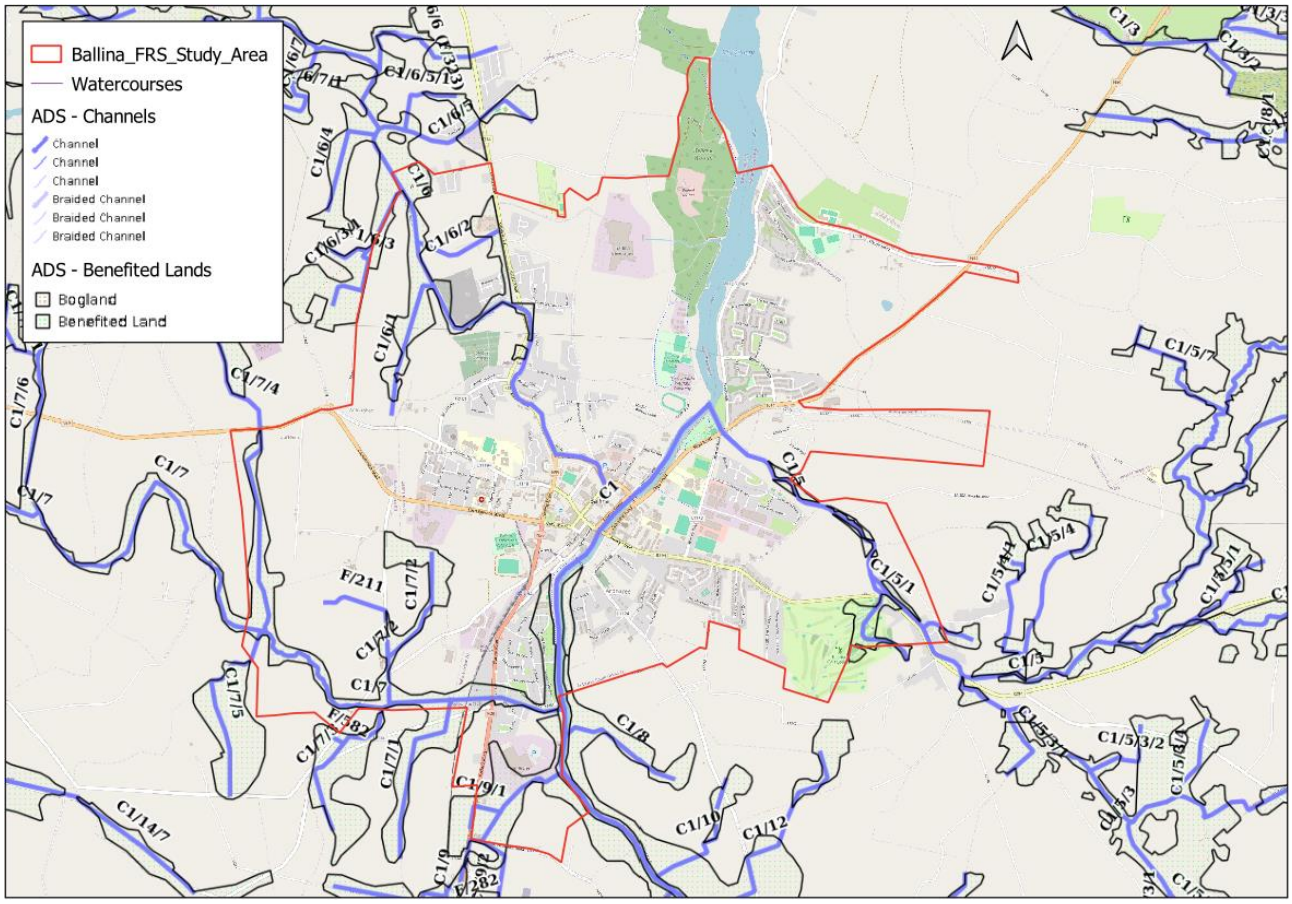

Figure 12-6 Arterial Drainage Scheme Features within the Scheme Area

12.3.1.5 Water Dependent Ecological Receptors

The River Moy SAC and the Killala Bay/Moy Estuary SAC both intersect the study area and has water dependent habitats. The Killala Bay/Moy Estuary SPA also intersects the study area and has water dependent qualifying interests.

These are described in more detail in **Chapter 9: Aquatic Biodiversity**, **Chapter 10: Terrestrial Biodiversity** and **Chapter 11: Land, Soil, Geology & Hydrogeology**.

12.3.1.6 Storm Water Overflows

The Ballina Wastewater Treatment Plant (WWTP) is situated on the left bank of the River Moy approximately 1.3km downstream of the Lower Bridge. It has a plant capacity PE (Population Equivalent) of 25,000 and serves Ballina Town and its environs. There are nine licenced discharges to the River Moy and one to the Brusna associated with the combined sewer network serving the plant. These are shown in **Figure 12-7** below.

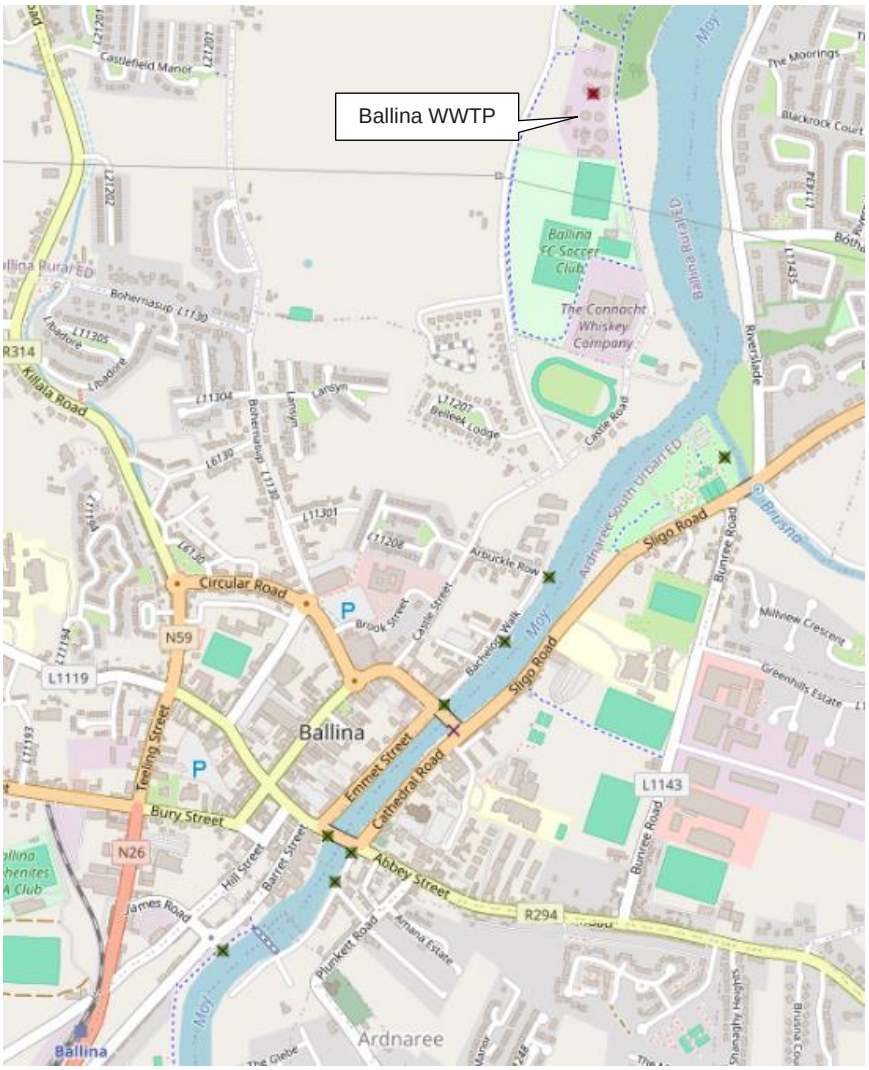

Figure 12-7 Wastewater Emission Points

Effluent monitoring is carried out upstream and downstream of the primary discharge. The most recent Annual Environmental Report from 2022[1] indicates the discharge to the River Moy is compliant with its emission limit values. There are also a number of surface water sewers discharging to the River Moy within the Study Area.

Further details on the existing sewer networks and their interaction with the Proposed Scheme are provided in **Chapter 16: Material Assets (Waste & Utilities)**.

12.3.1.7 River Moy & Moy Estuary

The River Moy rises in the Ox Mountains in Co. Sligo. It flows southwest to Barren Hill in Co. Mayo before turning north towards Ballina Town, where it transitions to the Moy Estuary. The estuary causes a tidal influence as far upstream as the Salmon Weir in Ballina Town (refer to **Chapter 5: Project Description**).

The section of the River Moy within the study area is coded by the EPA for the purposes of WFD reporting as the Moy_120 river waterbody (EPA code IE_WE_34M021100). This terminates at the Upper Bridge crossing of the river, whereafter the watercourse becomes the Moy Estuary (EPA code IE_WE_420_0300). The river divides subcatchments 34_10 Moy_SC_090 and 34_6 Moy_SC_100.

[1] The 2022 Annual Environmental Report for Ballina WWTP (Irish Water, 2022) is available at: https://www.water.ie/docs/aers/2022/d0016-01_2022_aer.pdf

The latest EPA monitoring data indicates a WFD ecological status for the period 2016-2021 of *Moderate* and its risk status is *At Risk*. It failed to achieve good chemical status due to elevated concentrations of benzo(a)pyrene, a carcinogenic hydrocarbon. The most recently reported Q-value from 2022 is 3-4 (*Moderate* biological status, *Slightly Polluted*) (monitoring station code RS34M021050 1 km upstream of Ardnaree Bridge (LHS)). The Moy_120 is subject to diffuse urban and morphological pressures.

The Moy Estuary also has *Moderate* status and is *At Risk* from nutrient pollution and is subject to pressures from agriculture and urban and domestic waste water.

There are nine licensed SWO discharges from Ballina WWTP to the River Moy (Licence No. D0016-01). The emissions are compliant as of 2022[2].

There is one licenced emission point from an IPPC (Integrated Pollution Prevention and Control) facility on the left bank of the River Moy to the south of the town, Hollister ULC (Licence No. P0918-01), which includes emissions to sewers and water. These emissions are monitored.

The River Moy is a well-known salmon and trout fishery, with established fishing areas on the River Moy in Ballina. The river is an important asset for recreation and tourism for the town of Ballina (refer to **Chapter 7: Population**).

The River Moy is a source of flooding in Ballina Town. Hydrographs on the River Moy are extremely prolonged, with the river staying high typically for months during a winter flood. There are 149 (coastal) and 198 (fluvial) residential properties at risk from the Moy and 35 (coastal) and 65 (fluvial) commercial properties at risk. Several roads, a play park, a car park and two wastewater pumping stations are also at risk. Out of bank flooding from the Moy, occurs during the 50% AEP fluvial event.

12.3.1.8 Quignamanger

The Quignamanger is a small watercourse, extensively modified by numerous culverts, which begins just east of the N59 Road, on the north east side of Ballina Town. It then follows the path of Creggs Road through Quignamanger and outfalls into the Moy Estuary at Rathmeel Lawns, approximately 1.8 km downstream. It has a number of properties near its banks.

It has been modified further with the addition of a storm diversion culvert along Creggs Road. The majority of upstream flows are diverted down the diversion culvert and an additional inlet point, taking additional flow from the Quignamanger Stream, is located along the lower reach. These both re-join the main channel before the outfall into the Moy Estuary.

During a flood event the diversion culvert, at the second inlet, reaches capacity. The inlet and downstream manhole surcharge, resulting in out of bank flooding which travels overland through Rathmeel Lawns housing estate and Creggs Road. Additional head losses were identified at the diversion culvert's outlet where a weir and flap valve system are located. The culvert which conveys flow under Quay Road is also undersized.

The EPA names this watercourse DOOYEAGHNY_or_CLOONLOUGHAN_010 (code IE_WE_34D310990). It sits within the 34_11 Leaffony_SC_010 subcatchment. The latest EPA monitoring data indicates a WFD ecological status for the period 2016-2021 of *Good* and its risk status is *Review*.

There are 20 residential properties at risk from the Quignamanger and 1 commercial property at risk from fluvial flooding. Out of bank flooding from the Quignamanger occurs during the 50% AEP fluvial event.

12.3.1.9 Bunree / Behy Road

The Bunree River rises at Quignashee, northeast of Ballina Town. It flows through the Knocknalyre and Riverslade urban areas where it joins the Moy Estuary. The natural route of the watercourse has been altered compared to the route shown on the 25-inch historic mapping. The current route of the watercourse is closely aligned to the Behy road and there are a number of short culverts under access roads and driveways and a 360 m long culvert under larger developments. It also passes under the Sligo Road (N59).

[2] https://www.water.ie/docs/aers/2022/d0016-01_2022_aer.pdf accessed 14/02/2024

Out of bank flooding occurs in numerous locations along the Behy Road due to many of the Bunree River culverts being undersized. Out of bank flooding from the Bunree occurs during the 50% AEP event.

The EPA names this watercourse DOOYEAGHNY_or_CLOONLOUGHAN_010 (code IE_WE_34D310990) i.e. the same as the Quignamanger, and it sits within the 34_11 Leaffony_SC_010 subcatchment. Its WFD status is not differentiated from the Quignamanger, i.e. *Good* ecological status and *Review* risk status.

There are 5 residential properties at risk from the Bunree and 3 commercial properties at risk from fluvial flooding. Three roads and a water pumping station are also at risk.

12.3.1.10 Brusna (Glenree)

The Brusna River (a.k.a. the Glenree) rises at the Knocknasliggaun mountain in Count Sligo, approximately 21 km east of Ballina. The Glenree is known as Brusna River downstream of Rathkip where the Downhill River joins with it. The Downhill River is a series of ditches that flow through Ballina Golf Club. The Brusna River flows through a number of rocky weirs along its route through Ballina. It also flows through an arch road bridge (under N59) around 200 m upstream of its confluence with the Moy Estuary. The Glenree River forms part of the River Moy SAC. The EPA names this watercourse GLENREE_030 (code IE_WE_34G010200) and it sits within the 34_9 Glenree_SC_010 subcatchment.

This subcatchment was identified as an Area for Action, recommended for further characterisation and action in the catchment for the 3rd Cycle River Basin Management Plan under the category of ‘Restoration’. The leading organisation is LAWPRO.

The GLENREE_010 and GLENREE_020, upstream of GLENREE_030, have high ecological status objectives.

The latest EPA monitoring data indicates a WFD ecological status for the period 2016-2021 of *Good* and its risk status is *Not At Risk*. The most recently reported Q-value from 2022 is 4-5 (*Good* biological status, *Unpolluted*) (monitoring station code RS34G010200 at the Sligo Road crossing, approximately 150 m upstream of the confluence with the Moy).

There are 3 residential properties at risk from the Brusna and no commercial properties at risk from fluvial flooding. Three roads are also at risk. Out of bank flooding from the Brusna occurs during the 50% AEP fluvial event.

12.3.1.11 Tullyegan

The Tullyegan River rises at Cloontykillew townland approximately 6.9 km upstream of its confluence with River Moy at Rehins Fort in the south of Ballina Town. The river flows under the railway and N26 national road. Two other smaller watercourses (Knocksbarrett and Scotchfort) join the Tullyegan River upstream of the Commons housing estate. Downstream of the N26 crossing the Tullyegan riverbanks form the boundary walls to a number of residential properties/estates.

The EPA names this watercourse TULLYEGAN_010 (code IE_WE_34T830920) and it sits within the 34_6 Moy_SC_100 subcatchment.

The latest EPA monitoring data indicates a WFD ecological status for the period 2016-2021 of *Moderate* and its risk status is *Review*. The EPA has noted hydromorphology pressure on this watercourse, possibly due to the OPW’s ADS.

There are 2 residential properties at risk from the Tullyegan and no commercial properties at risk from fluvial flooding. Out of bank flooding from the Tullyegan occurs during the 20% AEP fluvial event.

12.3.2 Evolution of the Environment in the Absence of the Proposed Scheme

In the absence of the Proposed Scheme, the current hydrological regime within the study area would not be expected to change significantly. Flooding would continue to occur at present day locations and would likely extend to other locations due to climate change and increased catchment urbanisation.

The impact on water quality in the absence of the Proposed Scheme is further discussed in **Chapter 9: Aquatic Biodiversity**. The impact on recreational amenities in the absence of the Proposed Scheme is further discussed in **Chapter 7: Population**.

12.4 Description of the Likely Significant Effects

The following subsections provide a description of the likely significant effects of the Proposed Scheme on water in cumulation with other existing development in the area. A description of the likely significant effects in cumulation with approved development i.e., development not yet built, is presented in **Section 12.8** based on the detailed methodology for CIA included in **Chapter 20: Interactions & Cumulative Effects**.

The impact interactions between water and other environmental factors are identified and described in **Chapter 20: Interactions & Cumulative Effects** and assessed throughout **Section 12.4**.

The sensitivity of each receptor is based on **Table 12-2** and the magnitude of the impact on each receptor is based on **Table 12-3**. The final rating of the significance of the impact is based on **Table 12-5**.

12.4.1 Construction Phase

12.4.1.1 Water Quality

Materials used or generated on construction sites or in construction activities can contaminate surface waters (CIRIA, 2001).

One of the main contaminants is suspended solids, which can arise from uncontrolled runoff from earthworks, haulage routes and stockpiles. Dewatering activities, in-stream works and enabling works may also generate sediment-laden runoff.

Another contaminant is cementitious particles, sources of which include the pouring of concrete, runoff from freshly poured concrete and washout of concrete delivery trucks and equipment. Cementitious particles can elevate the pH of waters they contaminate and require large dilution volumes to return the receiving waters to their baseline level.

Chemical status of surface waters can also be affected by hydrocarbons which can arise from runoff or leakage from machinery, accidental spillages during refuelling or storage of petroleum-based products. Biological contamination can occur if sewage from compound areas or other temporary toilet facilities is not properly managed.

Both natural and manmade drainage networks provide direct pathways from the source of pollutants at construction areas to the surrounding receptors (watercourses). Pumping activity due to dewatering may also provide a direct pathway. Potential impacts may be more pronounced where works take place within watercourses (‘instream works’) or directly adjacent to watercourses, due to the proximity of the sources to the receptors shortening the pathway.

Sources of water, which acts as a carrier between the source of pollutants and the receptors, include rainfall, groundwater pumped out of excavations, runoff from washing of surfaces and construction plant, and overland flood waters.

A range of mitigation measures have been incorporated into the proposed construction phasing and methodology to ensure minimal impacts on water quality during the construction phase of the Proposed Scheme; refer to **Chapter 5: Project Description**. Further mitigation measures are proposed in **Section 12.5** of this Chapter.

Water quality impacts on watercourses primarily relate to their ability to support aquatic ecology. Therefore, an impact assessment on water quality as a supporting element of aquatic ecology has been carried out in **Chapter 9: Aquatic Biodiversity**. Water quality impacts on compliance with WFD objectives is discussed in **Section 12.4.3**. Water quality impacts relating to groundwater are assessed in **Chapter 11: Land, Soil, Geology and Hydrogeology**.

12.4.1.1.1 Magnitude of Impact

The potential impact on water quality due to construction activities could result in a negative impact on the integrity of a receiving waterbody. The magnitude will vary depending on the temporal and spatial extent of a pollution incident, the distance to the receiving waterbody, the contaminants involved, the dilution capacity of the receiving waterbody, and the antecedent environmental conditions.

In general, a short-term, reversible and **Moderate Adverse** impact can be expected in the absence of mitigation, causing a partial loss of a fishery or amenity.

12.4.1.1.2 Sensitivity of the Receptors

River Moy

The River Moy and Moy Estuary are protected European Sites, with water-dependant qualifying interests. The River Moy is also a designated salmonid water and is an important recreational asset. Therefore, the receptor's sensitivity to water quality is considered to be **Extremely High**.

Quignamanger

No water quality data is available from the EPA for this watercourse. The EPA has assigned it a low-confidence Good status based on modelling. It is not a designated European or fisheries site. An ecological evaluation of County Importance is assigned in **Chapter 9: Aquatic Biodiversity**. Therefore, the receptor's sensitivity to water quality is considered to be **High**.

Bunree

No water quality data is available from the EPA for this watercourse. The EPA has assigned it a low-confidence Good status based on modelling; however, it does not distinguish between this highly modified watercourse and the Quignamanger. It is not a designated European or fisheries site. An ecological evaluation of Local Importance is assigned in **Chapter 9: Aquatic Biodiversity**. Therefore, the receptor's sensitivity to water quality is considered to be **Medium**.

Brusna

The River Brusna is a protected European Site, with water-dependant qualifying interests. Therefore, the receptor's sensitivity to water quality is considered to be **Extremely High**.

Tullyegan

No water quality data is available from the EPA for this watercourse. The EPA has assigned it a low-confidence Moderate status based on modelling. It is not a designated European or fisheries site. An ecological evaluation of Local Importance is assigned in **Chapter 9: Aquatic Biodiversity**. Therefore, the receptor's sensitivity to water quality is considered to be **Medium**.

12.4.1.1.3 Significance of the Effect

River Moy

Overall, the magnitude of the impact is deemed to be Moderate Adverse, and the sensitivity of the receptor is considered to be Extremely High. The effect will, therefore, in the absence of mitigation, be **Profound**.

Quignamanger

Overall, the magnitude of the impact is deemed to be Moderate Adverse, and the sensitivity of the receptor is considered to be High. The effect will, therefore, in the absence of mitigation, be of **Significant/Moderate** significance.

Bunree

Overall, the magnitude of the impact is deemed to be Moderate Adverse, and the sensitivity of the receptor is considered to be Medium. The effect will, therefore, in the absence of mitigation, be of **Moderate** significance.

Brusna

Overall, the magnitude of the impact is deemed to be Moderate Adverse, and the sensitivity of the receptor is considered to be Extremely High. The effect will, therefore, in the absence of mitigation, be **Profound**.

Tullyegan

Overall, the magnitude of the impact is deemed to be Moderate Adverse, and the sensitivity of the receptor is considered to be Medium. The effect will, therefore, in the absence of mitigation, be of **Moderate** significance.

12.4.1.2 Drinking Water

Utility diversions to facilitate the construction works may include watermains (see **Chapter 5: Project Description**), which would cause temporary outages for users in and around Ballina. Such outages are typically short duration (<48 hours) and notice to affected customers is provided in advance, resulting in a negligible impact. The requirement to divert watermains will be confirmed at the detailed design stage.

12.4.1.3 Flood Risk

Construction stage flooding impacts can be exacerbated when works areas occupy a significant portion of the floodplain or channel, thereby temporarily restricting flood storage availability and channel conveyance. They can also be caused by issues relating to pump failures, leaks, spillages and drainage issues.

12.4.1.3.1 Magnitude of Impact

River Moy

The temporary installation of cofferdams and access ramps in the River Moy is required to facilitate the construction and demolition of flood walls along the quays. This has the potential to increase flooding due to a reduction in channel storage and conveyance.The area of the River Moy that will be dammed to create working room will be restricted to a maximum of 6,600 m^2. The stone ramps descending from the left bank to the River Moy riverbed will cover an area of approximately 600 m^2.

The cofferdam will be installed during the appropriate instream works window which corresponds to low flow conditions. It will remain in place during the winter months. The top level of the cofferdam will be at approximately the 10% AEP flood level, meaning it will be overtopped in larger flooding events and not result in a loss of storage for such events.

In the absence of modelling to confirm the rise in peak flood level due to loss of storage, this is estimated to cause a temporary, **Small Adverse** impact.

The removal of existing quay walls has the potential to temporarily reduce the existing level of protection locally. However, it is noted that there are existing openings for amenity access in these walls and seepage through the existing walls, and hence the walls do not fully defend these areas from flooding. In the absence of modelling to confirm the rise in peak flood level due to temporary removal of quay walls, this is estimated to cause a temporary, **Small Adverse** impact.

Quignamanger

A temporary cofferdam or piped flume may be required to construct the instream works. The instream works footprint is 200 m^2, creating a minor reduction in flood storage and conveyance. In the absence of modelling to confirm, this is estimated to cause a temporary, **Small Adverse** impact.

Bunree

Over pumping will be needed during the upgrade of the culvert. In the absence of mitigation, there is a risk that pump failure could result in minor localised flooding.

The instream works footprint is 900 m^2, creating a minor reduction in flood storage and conveyance. In the absence of modelling to confirm, this is estimated to cause a temporary, **Small Adverse** impact.

Brusna

Instream works are required to install scour protection at the Rathkip/Shanaghy access bridge. This will involve damming the works area with sandbags. The instream works footprint is 300 m^2. In the absence of modelling to confirm, this is estimated to cause a temporary, **Small Adverse** impact.

Tullyegan

The instream works footprint is 900 m^2, creating a minor reduction in flood storage and conveyance. In the absence of modelling to confirm, this is estimated to cause a temporary, **Small Adverse** impact.

12.4.1.3.2 Sensitivity of the Receptors

River Moy

There are 198 residential and 65 commercial properties in the River Moy fluvial floodplain, and 184 properties in the coastal floodplain at risk. Therefore, this receptor's sensitivity to flooding is considered to be **Very High**.

Quignamanger

There are 20 residential properties and one commercial property in the Quignamanger floodplain at risk, therefore this receptor's sensitivity to flooding is considered to be **High**.

Bunree

There are 5 residential and three commercial properties in the Bunree floodplain, therefore this receptor's sensitivity to flooding is considered to be **High**.

Brusna

There are 3 residential properties in the River Brusna floodplain, however the only access and egress route for nine residential properties at Rathkip/Shanaghy Heights is also in the floodplain. Therefore, this receptor's sensitivity to flooding is considered to be **High**.

Tullyegan

There are 2 residential properties in the Tullyegan floodplain, therefore this receptor's sensitivity to flooding is considered to be **Medium**.

12.4.1.3.3 Significance of the Effect

River Moy

Overall, the magnitude of the impact is deemed to be Small Adverse, and the sensitivity of the receptor is considered to be Very High. The effect will, therefore, in the absence of mitigation, be of **Significant/Moderate** significance.

Quignamanger

Overall, the magnitude of the impact is deemed to be Small Adverse, and the sensitivity of the receptor is considered to be High. The effect will, therefore, in the absence of mitigation, be of **Moderate/Slight** significance.

Bunree

Overall, the magnitude of the impact is deemed to be Small Adverse, and the sensitivity of the receptor is considered to be High. The effect will, therefore, in the absence of mitigation, be of **Moderate/Slight** significance.

Brusna

Overall, the magnitude of the impact is deemed to be Small Adverse, and the sensitivity of the receptor is considered to be High. The effect will, therefore, in the absence of mitigation, be of **Moderate/Slight** significance.

Tullyegan

Overall, the magnitude of the impact is deemed to be Small Adverse, and the sensitivity of the receptor is considered to be Medium. The effect will, therefore, in the absence of mitigation, be of **Slight** significance.

12.4.1.4 Hydromorphology

Hydromorphology describes the physical form of a watercourse as well as the dynamic processes occurring within it. Flow and sediment movement are the main controlling factors. Good hydromorphological conditions are important for supporting aquatic life. Impeding the lateral movement of the watercourse or disconnecting it from its floodplain (e.g. by constructing a wall on the riverbank) and increasing scour or erosion potential (e.g. by increasing flow velocities) are typical examples of negative hydromorphological impacts that could occur due to flood schemes.

Impacts on hydromorphological conditions in relation to the ability of watercourses to support aquatic life is carried out in **Chapter 9: Aquatic Biodiversity**. Hydromorphological impacts relating to scour and erosion are considered in this Chapter for the operational phase only (when potential changes to the long term flow regime have been established).

12.4.2 Operational Phase

12.4.2.1 Water Quality

During the operational phase, a reduction in urban flooding will occur. Floodwaters passing through urban environments typically entrain pollutants such as litter, sediments, heavy metals and hydrocarbons from roads and footpaths, and potentially cause surcharging of sewer systems resulting in increased risk of biological contamination. This has a negative impact on the watercourse to which the floodwaters return. Therefore, the reduction in urban flooding during the operational phase will have a positive impact on water quality.

Four new pumping stations will be installed as part of the Proposed Scheme to manage excess surface water during floods (refer to **Chapter 5: Project Description** for details). The pumping stations will collect urban runoff and discharge directly to the River Moy. The sensitivity of the River Moy is Extremely High (refer to **Section 12.4.1.1.2**) and without mitigation, these emissions have the potential to convey pollutants directly to the watercourse, causing intermittent, temporary, moderate adverse impacts on water quality.

This potential positive and negative impacts on water quality during the operational phase as outlined above are discussed in **Chapter 9: Aquatic Biodiversity**.

12.4.2.2 Drinking Water

No negative impacts on drinking water are expected to occur due to the operational phase of the Proposed Scheme. The Quignalecka Road Water Pumping Station will be defended from flood risk which can be considered a positive impact.

Construction phase impacts on watermains are discussed further in **Chapter 16: Material Assets (Waste & Utilities)**.

12.4.2.3 Flood Risk

Overall positive impacts on flood risk are to be expected from flood relief schemes, as the overall objective of such projects is to protect communities from flooding. This will benefit residential and commercial properties as well as material assets such as roads and amenities. However, negative effects can also arise:

- Once a scheme is constructed, a watercourse can become more restricted in the defended areas due to the presence of hard defences along its banks, disconnecting it from its natural floodplain. This potentially increases the flood risk downstream due to loss of upstream flood storage and increased conveyance;

- Works that alter the route of a watercourse or its degree of culverting may increase upstream and downstream flood risk by altering the existing hydrological regime or by increasing the risk of blockages. The design proposals must be subject to careful hydraulic analysis to minimise this risk. Upgrading of culverts to larger diameters can lead to increased flood risk due to increased conveyance capacity;
- Interference with land drainage can occur when placing structures on riverbanks that cut off or interfere with constructed or natural drainage outlets.

The Proposed Scheme has been designed to minimise or eliminate potential upstream and downstream effects.

12.4.2.3.1 Magnitude of Impact

River Moy

The proposed flood walls will partially protect the town centre in the 1% AEP fluvial flooding event and fully protect it in the 0.5% AEP tidal flooding event. Flooding occurring due to the Knockanelo stream will continue to cause flooding in the town centre between Emmet Street and Pearse Street, between Bachelor's Walk and Castle Street, and other localised areas (refer to **Figure 12-8** and **Figure 12-9**). Further downstream of the town centre, tidal flooding will continue to affect Ballina Quay in the 0.5% AEP tidal event (refer to **Figure 12-11**).

A minor increase in fluvial flood extents is predicted at the confluence of the River Moy and the Brusna River, in the open space between the rivers and the Riversdale Road. This occurs at lands that are already within the tidal flood extents. There is no increased risk to properties or businesses.

Of the 198 residential and 65 commercial properties at risk within the River Moy, 157 residential properties and 50 commercial properties will be protected from flooding. There will be 41 residential properties and 15 commercial properties still at risk.

Given the reduction in predicted peak flood levels (>100mm) and properties exposed to flooding, this is considered to have a long term, **Major Beneficial** impact.

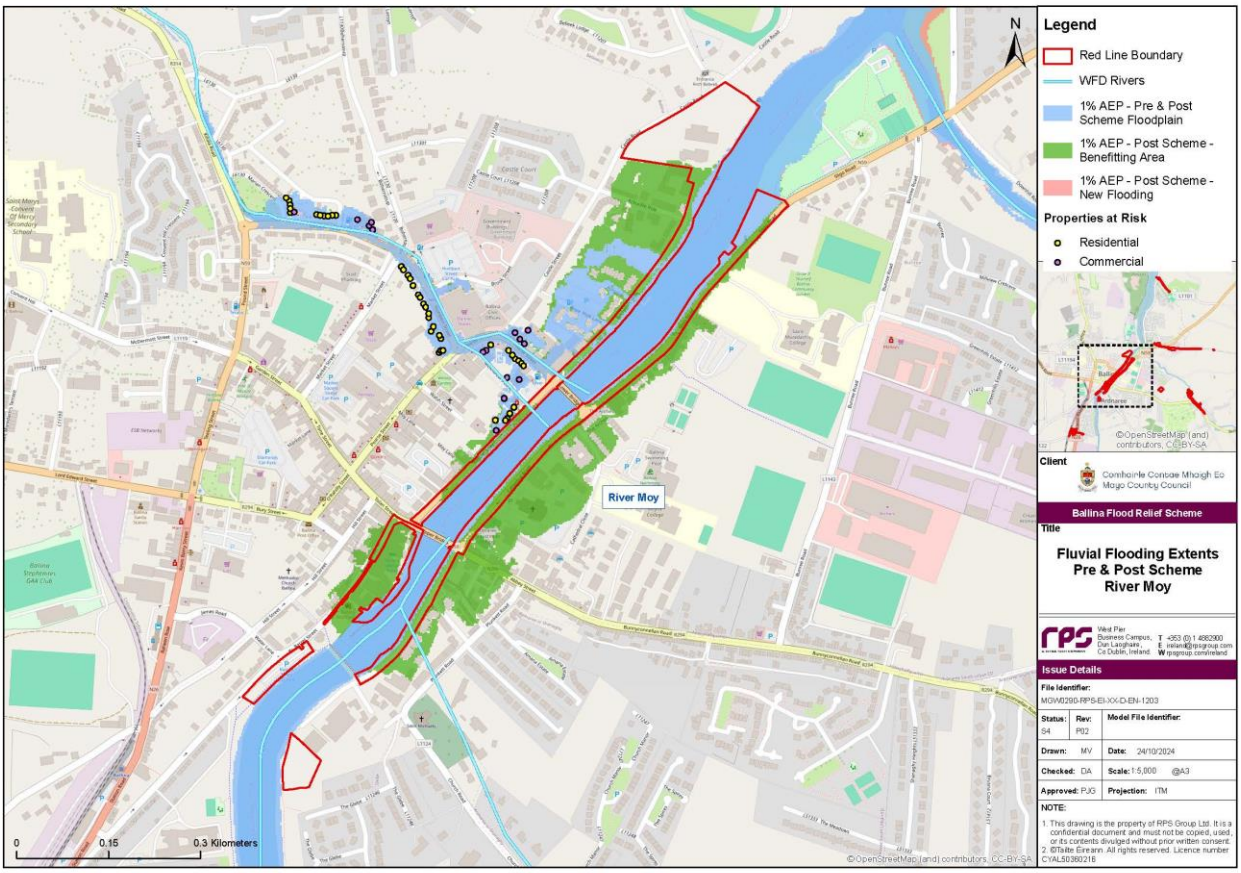

Figure 12-8 Operational Phase 1% AEP Fluvial Flood Extents (River Moy)

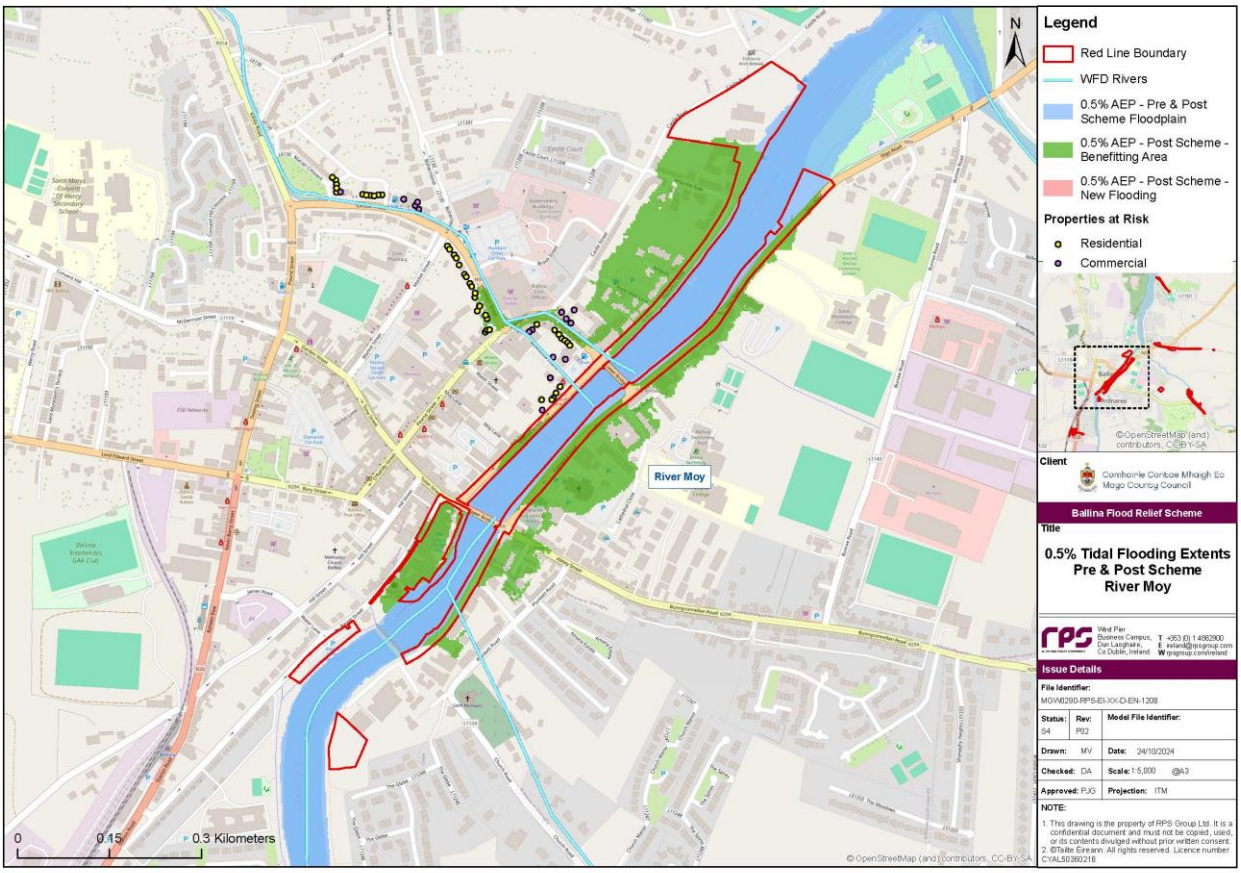

Figure 12-9 Operational Phase 0.5% AEP Tidal Flood Extents (River Moy)

Quignamanger

The proposed culvert upgrade and flood walls will fully protect the 21 properties at risk along the Quignamanger in the 1% AEP fluvial flooding event and the 0.5% AEP tidal flooding event (refer to **Figure 12-10** and **Figure 12-11**). A playing field, Creggs Road, Quay Road and a Wastewater Pumping Station will also be protected.

At the end of the diversion culvert there is an increase in flood levels when compared with the old route. This is due to flows which were previously lost and attenuated in the areas around the open watercourse, reaching this area. This area also has the main culvert joining from the Quignamanger watercourse, which combines with flooding from the diversion culvert in this location. However, the increased levels do not increase flood risk due to the walls being constructed as part of the Proposed Scheme. There will be no increased flood risk from the removal of the flap valve from the watercourse just before intersection of Creggs and Quay Roads.

Given the reduction in predicted peak flood levels (>100mm) and properties exposed to flooding, this is considered to have a long term, **Major Beneficial** impact.

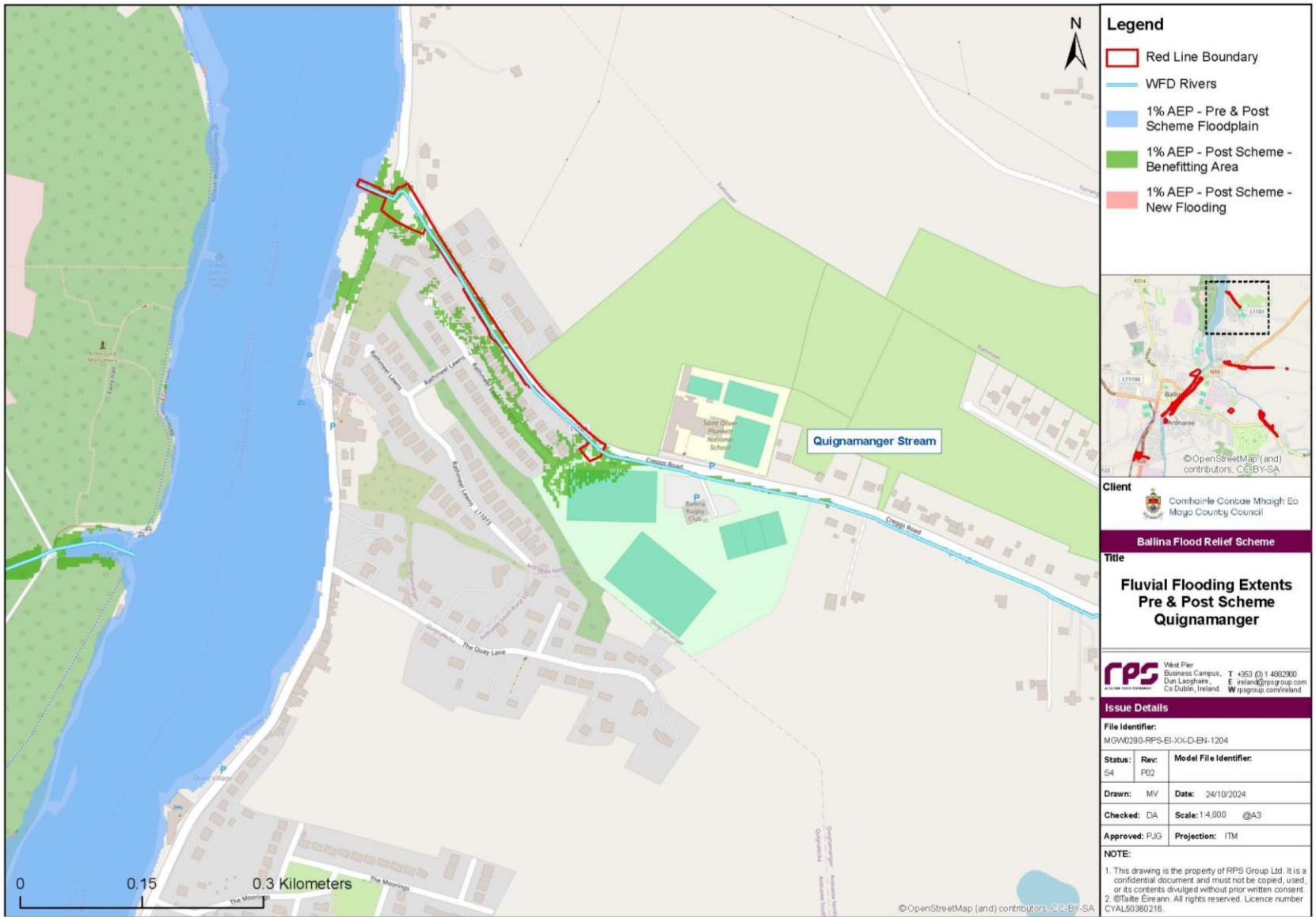

Figure 12-10 Operational Phase 1% AEP Fluvial Flood Extents (Quignamanger)

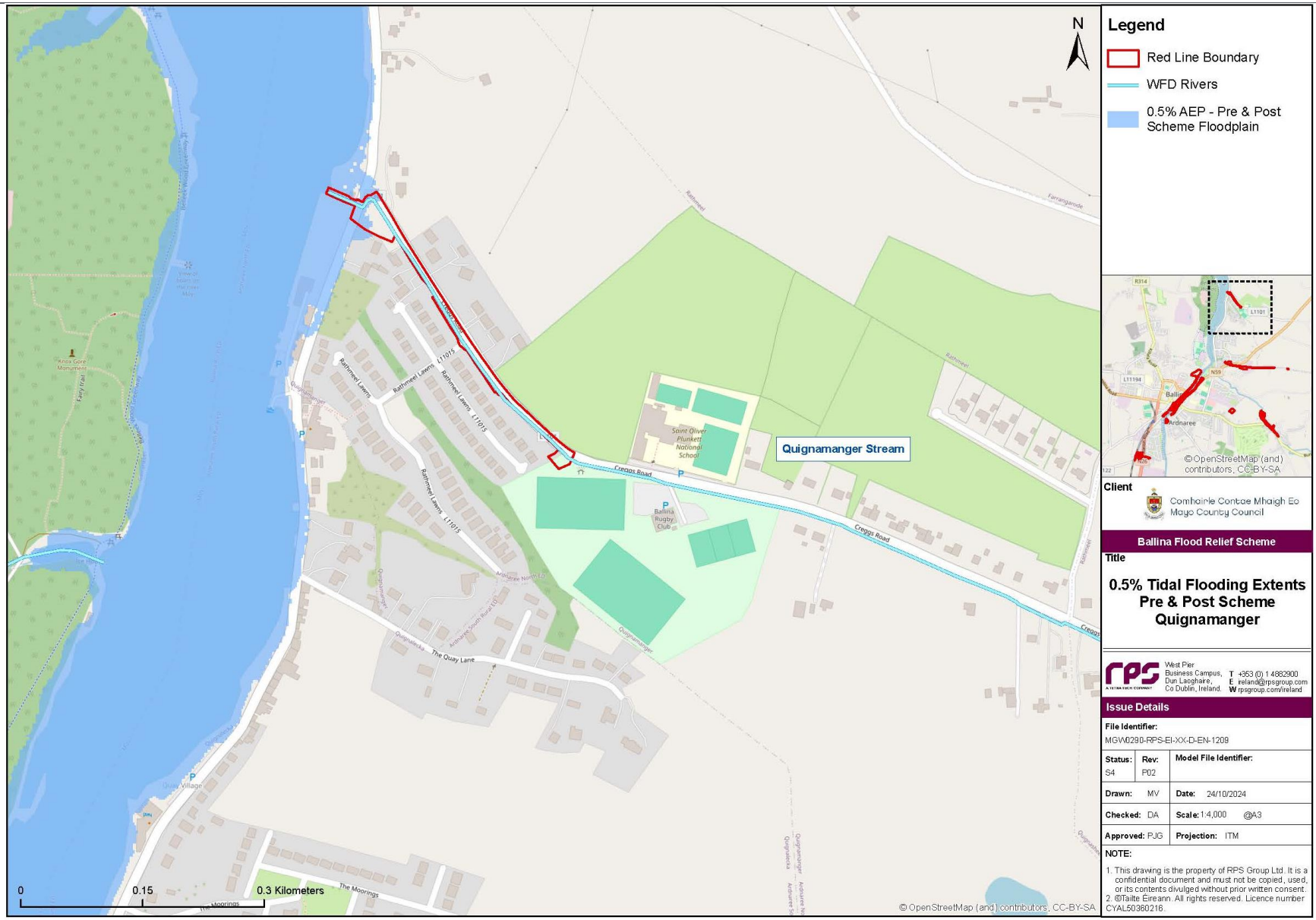

Figure 12-11 Operational Phase 0.5% AEP Tidal Flood Extents (Quignamanger)

Bunree

The proposed culvert will fully protect the 5 residential and 3 commercial properties at risk along the Bunree in the 1% AEP fluvial flooding event (refer to **Figure 12-12**:). The Behy Road, N59 Sligo Road, Quignalecka Road and the Water Pumping Station will also be protected. A minor increase in fluvial flood extents is predicted at the confluence of the Bunree and the River Moy at Riversdale road. This occurs in an area already within the tidal flood extents. There is no increased risk to properties or businesses. There will be no increased flood risk from the de-culverted section of the Bunree at Moyvale Park.

Given the reduction in predicted peak flood levels (>100mm) and properties exposed to flooding, this is considered to have a long term, **Major Beneficial** impact.

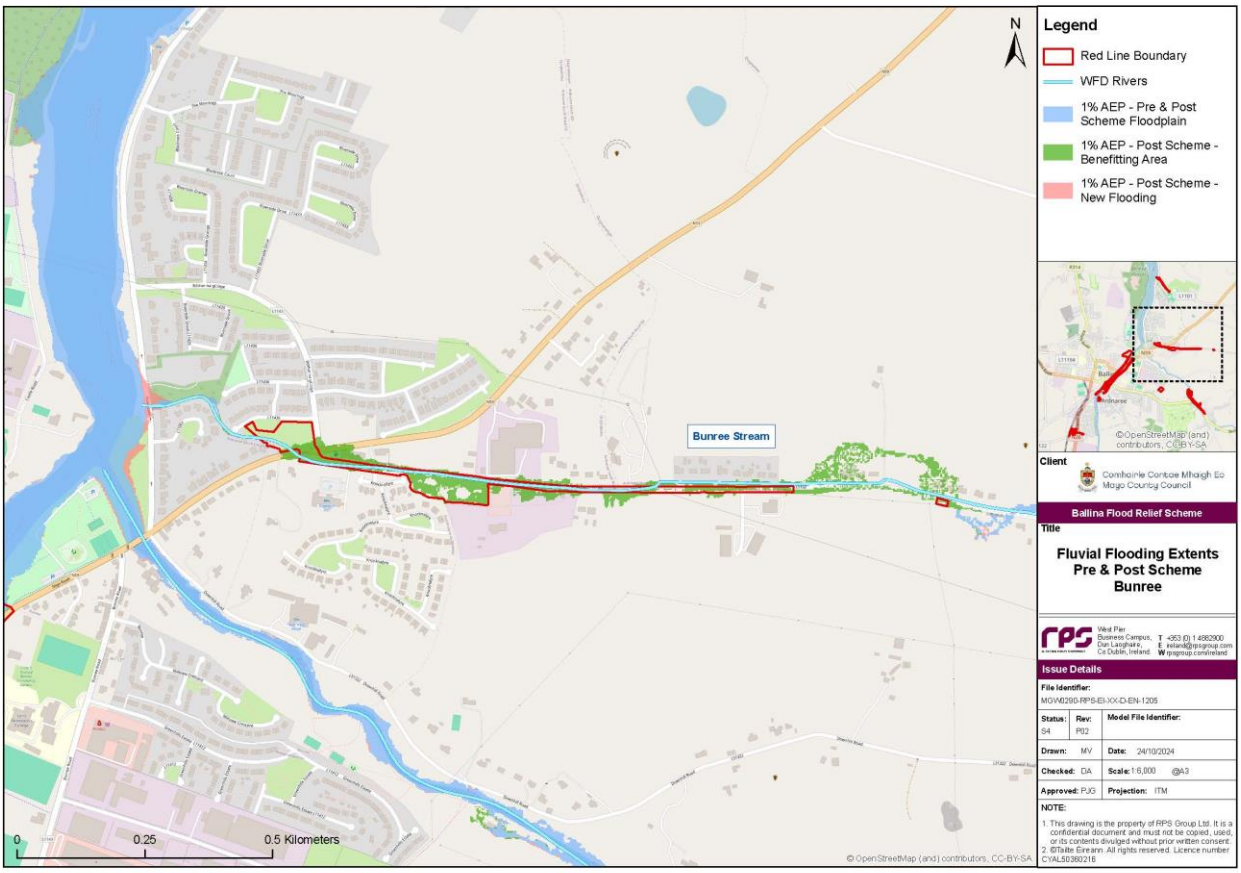

Figure 12-12: Operational Phase 1% AEP Fluvial Flood Extents (Bunree)

Brusna

The proposed flood walls and culvert upgrade will fully protect the 20 properties at risk along the River Brusna in the 1% AEP fluvial flooding event (refer to **Figure 12-13**). The R294, Shanaghy Heights road, and N59 Sligo Road will also be protected. A minor increase in fluvial flood extents is predicted in a greenfield area north of Shanaghy Heights, and along the left bank in the Shanaghy Heights area.

Given the reduction in predicted peak flood levels (>100mm) and properties exposed to flooding, this is considered to have a long term, **Major Beneficial** impact.

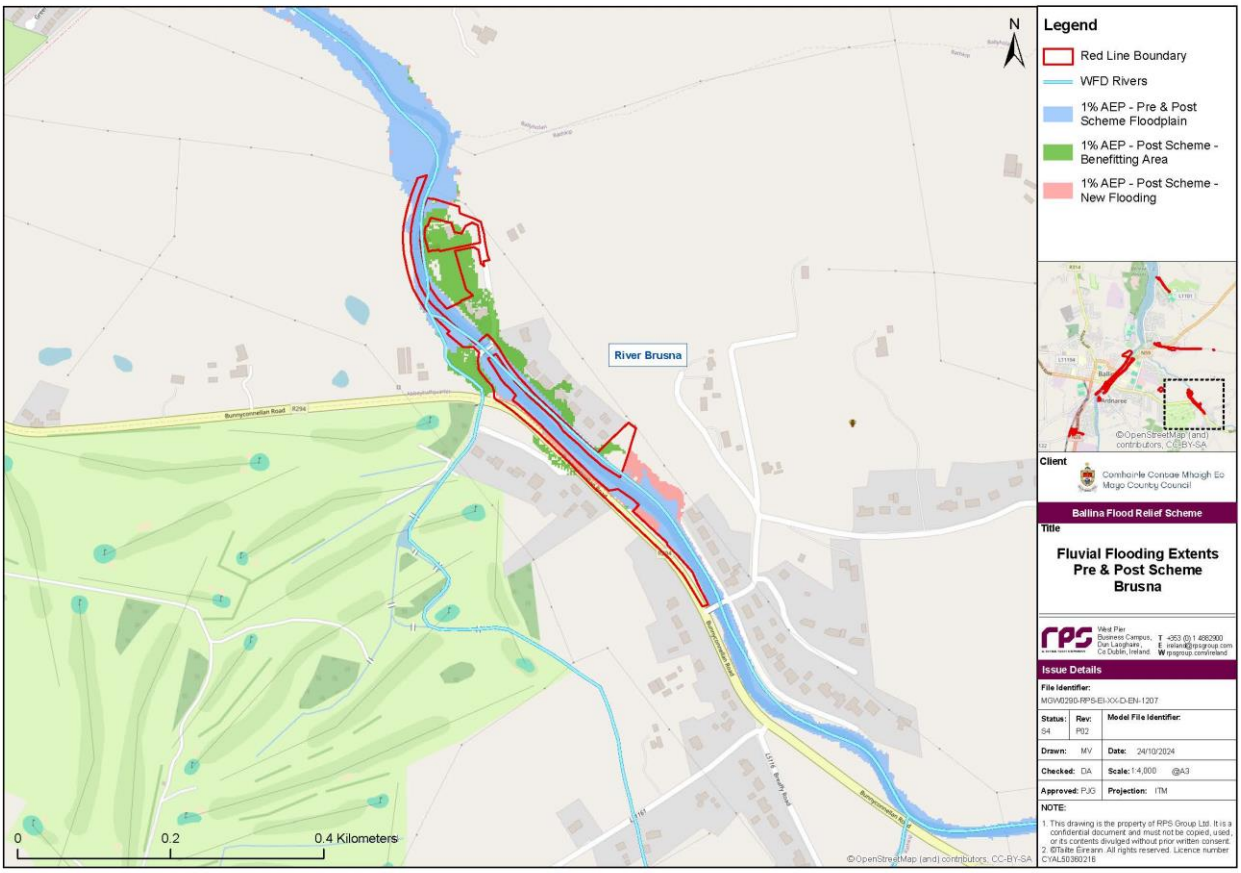

Figure 12-13 Operational Phase 1% AEP Fluvial Flood Extents (Brusna)

Tullyegan

The proposed flood walls will fully protect the 2 properties at risk along the Tullyegan in the 1% AEP fluvial flooding event (refer to **Figure 12-14**). No increased flood extents are predicted as a result of the works.

Given the reduction in predicted peak flood levels (>100mm) and properties exposed to flooding, this is considered to have a long term, **Major Beneficial** impact.

Figure 12-14 Operational Phase 1% AEP Fluvial Flood Extents (Tullyegan)

12.4.2.3.2 Sensitivity of the Receptors

The sensitivities of these receptors are described in **Section 12.4.1.3.2**.

12.4.2.3.3 Significance of the Effect

River Moy

Overall, the magnitude of the impact is deemed to be Major Beneficial, and the sensitivity of the receptor is considered to be Very High. The effect will, therefore, be of **Profound** positive significance.

Brusna

Overall, the magnitude of the impact is deemed to be Major Beneficial, and the sensitivity of the receptor is considered to be High. The effect will, therefore, be **Significant** positive.

Tullyegan

Overall, the magnitude of the impact is deemed to be Major Beneficial, and the sensitivity of the receptor is considered to be Medium. The effect will, therefore, be **Significant** positive.

Bunree

Overall, the magnitude of the impact is deemed to be Major Beneficial, and the sensitivity of the receptor is considered to be High. The effect will, therefore, be **Significant** positive.

Quignamanger

Overall, the magnitude of the impact is deemed to be Major Beneficial, and the sensitivity of the receptor is considered to be High. The effect will, therefore, be **Significant**.

12.4.2.4 Hydromorphology

The potential for scour and erosion may increase due to increased water velocities and flow patterns at riverbanks and in-stream structures such as bridge piers, particularly during flood conditions. The hydraulic model was analysed to quantify potential changes to the pre- and post-development maximum water velocities at discrete cross sections along each affected watercourse in the 1% AEP fluvial flood event to estimate the impact of the Proposed Scheme on scour and erosion potential. Further details of the model outputs, including reported locations, are contained in **Appendix 9.8**.

The TII guidelines cited in **Section 12.2.5** do not provide guidance on evaluating the importance/sensitivity of hydromorphological features. Therefore, a case-by-case assessment is made for each watercourse below.

River Moy

For the 1% AEP event, a velocity increase of 0.02 m/s (+1.2%) is predicted at 34MOYR00428 compared to the baseline scenario. The minor increase is considered negligible, especially considering the model shows tidal forces have a much larger effect on velocities in this reach and these will not be affected by the Proposed Scheme. Therefore, an **Imperceptible** effect on scour and erosion potential is predicted.

Quignamanger

For the 1% AEP event, a velocity increase of 0.742 m/s (+195.8%) at 34QUIG00006I is predicted compared to the baseline scenario. The large increases in velocity are due to improved flow conveyance and removal of constraints. This occurs in the area directly upstream of the Creggs Road and Quay Road intersection, which will be reconfigured under the Proposed Scheme, including the installation of new flood walls which will be designed to account for the predicted flows. Therefore, no mitigation is required at this location and an **Imperceptible** effect on scour and erosion potential is predicted.

Bunree

For the 1% AEP event, velocity increases at Moyvale Park of 2.613 m/s (+537.7%) at 34BNRE379, and 0.758m/s (+259.6%) at 34BNRE357 are predicted compared to the baseline scenario. The large increases in velocity are due to improved flow conveyance in the proposed upstream culvert, and removal of constraints. An open channel will be reinstated at this location.

Due to the large velocity increase and the outlet of the culvert occurring at a bend upstream of a proposed open reach, mitigation has been included in the design of the Proposed Scheme to protect the bed from scour and the banks from erosion. Therefore, an **Imperceptible** effect on scour and erosion potential is predicted.

Brusna

The average velocity at the upstream side of the Shanaghy Heights bridge is 1.87 m/s during the baseline 1% AEP scenario, increasing to 1.93 m/s for the 1% AEP preferred option (+3.3%). Downstream of the bridge, the average velocity is 1.83 m/s for the 1% AEP baseline scenario, increasing to 2.05 m/s for the preferred option scenario (+11.8%). The Proposed Scheme includes scour protection at the Shanaghy Heights Bridge and therefore an **Imperceptible** effect on scour and erosion potential is predicted.

Tullyegan

For the 1% AEP event, a velocity increase of 0.237 m/s (+24.2%) upstream of the N26 culvert is predicted compared to the baseline scenario. There are no known scour, sedimentation or erosion issues at this location at present. The velocities are also lower than they are at the upstream section before the railway

culvert, where there are also no known issues. Therefore, no mitigation is required at this location and an **Imperceptible** effect on scour and erosion potential is predicted.

12.4.3 WFD Considerations

The EU Water Framework Directive (WFD) is the principal framework for managing the water resources of the entire European Union. The environmental objectives of the WFD are set out in Article 4 of the Directive. The impact of the Proposed Scheme on the overall ecological status of relevant water bodies in terms of the objectives set out in Article 4(1) of the WFD has been assessed. Article 4(1)(a) requires that, within specified time frames, Member States shall:

- Prevent deterioration of the status of all bodies of surface water; and
- Protect, enhance and restore all surface water bodies, with the aim of achieving good status.

An assessment was carried out on the River Moy, Quignamanger, Bunree, Brusna and Tullyegan, as they are potentially affected by the Proposed Scheme. The Common Implementation Strategy (CIS) Guidance No. 36 (EC, 2017), provides a framework for carrying out the assessment. The assessment is contained in **Appendix 12.1**.

The assessment concludes that the Proposed Scheme will not cause a deterioration of status in any water body, nor will it compromise the attainment of good status where necessary. The Proposed Scheme is therefore compliant with WFD Article 4(1) objectives. The Proposed Scheme also advances the overall purpose of the WFD by contributing to mitigating the effects of floods, as per Article 1(e).

12.5 Mitigation Measures

12.5.1 Construction Phase

Water management measures described in the Construction Environmental Management Plan (CEMP) will be implemented by the contractor during the construction phase. A suitably qualified and experienced Environmental Clerk of Works (ECoW) will be employed for the duration of the scheme, including advance works and accommodation works, to oversee and ensure implementation of the CEMP.

General mitigation measures and controls relevant to water are listed below:

- Limit suspended solids from entering watercourses by placing controls at all sources and pathways including, at a minimum, the following measures:
    - Placing silt fencing between works areas and pathways to watercourses.
    - Passing sediment-laden runoff and dewatering effluent through settling tanks and silt bags before allowing discharge to watercourses.
    - Ensuring dewatering pumps are placed in sumps surrounded by drainage stone.
    - Prioritising infiltration of silt-laden water to ground through soak pits and infiltration trenches where feasible.
    - Stockpiling only allowed in designated areas.
    - Constructing ditches and installing silt fencing around stockpile areas (restricted to the compounds).
    - Placing sandbags and/or straw bales as check dams in drainage ditches to attenuate runoff and reduce erosion.
    - Regular road washing to prevent build-up of mud from construction vehicles, which may runoff into watercourses. Wheel wash facilities to be provided at exit points of all compound sites.
    - Delineating buffer zones of at least 1m along greenfield riparian works areas within which tracking of machinery and storage of construction materials will be prohibited.
    - Reviewing earthworks programming when prolonged rainfall is forecast.

- Limit cementitious particles from entering watercourses by placing controls at all sources and pathways including, at a minimum, the following measures:
    - Having dedicated, suitably prepared concrete washout areas for concrete chute and bowser washout, and cleaning of concrete contaminated plant and materials. Signs will be erected at works sites to inform concrete delivery drivers that washout is not permitted outside these areas.
    - Ensuring disposal of raw or uncured waste concrete is controlled using approved waste disposal and/or concrete wash-out pits to ensure that seepage to drains from the site is avoided.
    - Water collected in wash pits will be tankered off-site for treatment at an appropriate licensed facility, ensuring none is allowed to overflow or infiltrate to ground.
    - Employing best practice in bulk-liquid concrete management addressing pouring and handling, secure shuttering / formwork, ensuring adequate curing times. Where shuttering is used, measures will be put in place to prevent against shutter failure and control storage, handling and disposal of shutter oils.
    - Treating cement-laden runoff and dewatering effluent in settling tanks before allowing discharge to watercourses.
    - Dust suppression using water sprayers during demolition of quay walls or other activities resulting in the creation of cement dust.
- Limit hydrocarbons from entering watercourses by placing controls at all sources and pathways including, at a minimum, the following measures:
    - Training operatives in the use of spill kits and keeping spill kits at each work site.
    - Ensuring all fuels and oils are stored in bunded trays at least 20 m from any watercourses or surface water feature. Trays will be bunded to 110% of the capacity of the fuel volume.
    - Runoff from construction plant washdown to be collected and passed through an oil-water separator before release into the environment.
    - Staff parking to be restricted to designated areas (refer to **Chapter 6: Traffic & Transportation**).
    - Refuelling activities to be restricted to designated, bunded areas, at least 20 m from any watercourse or surface water feature.
    - All construction plant to be regularly maintained and checked for oil and fuel leaks before use. Drip trays to be available on site.
    - Consideration to be given to the use of biodegradable fuels and oils, where possible.
- Limit construction debris entering watercourses due to riverside wall construction by:
    - Installing edge protection systems resembling cantilevered scaffolding over the River Moy at Emmet Street to prevent debris and sediment from wall reconstruction falling into the river. The decking shall include a toe board and be underlain by geotextile to trap sediments that wash through the floor boards. The supports for the scaffolding shall not rest within the watercourse.
    - A floating boom will be deployed underneath the works areas to contain any floating debris or oil spills from spreading.
    - The construction work and the storage of materials shall take place on the roadside and not on the scaffold overhanging the watercourse.
- Flood preparedness:
    - Checking water levels at Rahans gauge on a daily basis or twice daily during times of high flow when works are occurring in the vicinity of the River Moy.
    - Monitoring the tide forecast.
    - Developing an emergency response and evacuation procedure for all works areas including removal of potential contaminants and construction plant, and appropriate measures to manage any potential flooding.

- Miscellaneous:
  - Following consultation with IFI, instream works are restricted to appropriate seasonal windows.
  - Instream works areas to be left clean of all residual construction waste and potential pollutants before re-flooding.
  - Instream working areas will be limited to 50 m lengths at any one time along the Ridgepool Road.
  - Backup pumps and generators to be in place where over pumping is taking place to mitigate flood risk.
  - If no foul sewer connection is available at the compound and works sites, foul water is to be stored and tankered away for treatment as needed.
  - Construction sequencing to proceed from downstream to upstream on all watercourses.
  - Customers to be notified in advance of watermain outages to allow time to prepare.
- Measures that have been incorporated into the design:
  - The timing of the instream works will reduce the impact on aquatic wildlife and the dewatering requirements (refer to **Section 5.7.1**).
  - The timing of the instream works will reduce the likelihood of a high flow event occurring while they are taking place, minimising the potential increase in flood risk by occupation of the floodplain.
  - To minimise temporary reductions in floodplain storage on the Brusna, the instream works area cofferdam will have a top-level equivalent to the 50% AEP event. The sequencing will be such that the bridge parapet will be installed before the scour protection.
  - The bridge parapet to be installed on the Brusna will be prefabricated to reduce the risk of cementitious pollution on site.
  - Best practices to be adhered to as outlined in publications by CIRIA (2001, 2006a, 2006b) and IFI (Guidelines on protection of fisheries during construction works in and adjacent to waters).

Site-specific mitigation measures relevant to water are also discussed in **Chapter 9: Aquatic Biodiversity**. For monitoring requirements associated with the above mitigation measures, refer to **Section 12.7**.

12.5.2 Operational Phase and Maintenance Phase

An Operation and Maintenance Manual (O&M Manual) will be developed for Mayo County Council and will include an inspection and maintenance regime of all flood defence infrastructure. Maintenance activities may include structural repairs, culvert inspection and jetting, vegetation management, channel maintenance and pumping station maintenance.

To account for climate change, the scheme has been designed to be adaptable to the High End Future Scenario (HEFS) standard of protection (SoP) climate change in a manner that will require further construction activity such as raising walls or extending embankments (RPS, 2023a). Environmental assessments will be completed before such activity is carried out.

General mitigation measures relevant to water are listed below:

- Flood preparedness.
  - Operational protocols to be included in the O&M Manual.
- Measures that have been incorporated into the design.
  - The proposed walls on the Brusna have been set back as far as possible to mitigate disconnection to the floodplain;
  - A petrol interceptor will be fitted to surface water pumping stations outfalling to the River Moy to mitigate against hydrocarbons entering the watercourse during pumping;
  - Scour and erosion protection measures have been incorporated on the Brusna and Bunree watercourses.

12.6 Residual Impacts

Water Quality

The nature and location of the proposed construction works, both along and within watercourses, may result in residual temporary negative impacts on water quality and aquatic ecology, which are discussed in **Chapter 9: Aquatic Biodiversity**. Impacts will be mitigated by the measures outlined in **Section 12.5** and the monitoring measures outlined in **Section 12.7**, reducing the overall significance of the effect to **Imperceptible** on each of the watercourses considered in the assessment.

Flood Risk

During the construction phase, the increased risk of flooding due to temporary occupation of the floodplain will be mitigated by the top level of the cofferdams being set to the 10% AEP level and the timing of the works occurring during lower flow periods. With mitigation in place, the magnitude of the impact is reduced to Negligible (i.e. Negligible change in predicted peak flood level), and the overall significance of the effect will be **Imperceptible**.

During the operational phase, compared to the existing scenario, there will be an overall Major Beneficial effect on flood risk within the scheme area, as described in **Section 12.4.2.3**. 241 properties currently at risk from flooding in the 1% AEP fluvial event and 184 properties in the 0.5% AEP coastal flood events will be defended. This represents a **Significant** positive effect on flood risk. This relies on proper maintenance and operation of the scheme elements.

56 properties will continue to experience fluvial flooding from the Knockanelo Stream. Residual flooding will also occur in localised areas which do not experience flooding in the present day scenario, but which do not pose a risk to residential or commercial properties.

The hydraulic model indicates localised, negligible increases in flood extents occurring in the proposed scenario, primarily on greenfield sites subject to existing flooding. The increased extents do not put additional properties at risk.

Drinking Water Resources

No residual impacts on drinking water resources are anticipated.

Scour and Erosion

No residual impacts on scour and erosion are anticipated.

12.7 Monitoring

12.7.1 Construction Phase

The ECoW will carry out the monitoring activities during the construction phase, as set out in **Chapter 9: Aquatic Biodiversity.**

12.7.2 Operational Phase and Maintenance Phase

It is expected that the OPW will continue to monitor flows in the River Moy at Rahans gauging station and any other stations within the catchment as required. Any unforeseen changes in extreme flow volumes or increased frequency will be risk assessed in the context of the scheme design.

It is expected that the EPA will continue to monitor water quality at the existing locations during the operational phase of the scheme as part of its WFD obligations.

The O&M Manual will specify an inspection regime for all permanent elements of the scheme to ensure they remain in good working condition. This will include periodic structural inspections of flood defences, inspections and cleaning of culverts and flap valves, removal of debris from channels, and testing of pumping stations.

Operational protocols for preparing for and responding to flood events will also be detailed in the O&M Manual. Repairs and remediation works will be carried out on permanent scheme elements as needed.

12.8 Interactions and Cumulative Effects

Inter-relationships are the impacts and associated effects of different aspects of the Proposed Scheme on the same receptor. The potential for cumulative effects has been considered for the construction and operation of the Proposed Scheme cumulatively with other projects. Please see **Chapter 20: Interactions and Cumulative Effects** for further details on the potential interactions and cumulative effects for Water.

12.9 Schedule of Environmental Commitments

Please see **Chapter 22 Schedule of Environmental Commitments** which sets out all the mitigation and monitoring commitments to minimise the potential impacts for **Chapter 12: Water** during the construction and operational phase of the Proposed Scheme.

12.10 Chapter References

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