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CLONASLEE FLOOD RELIEF SCHEME

Environmental Impact Assessment Report
Chapter 11: Water

MDW0867
27 February 2025
S5.P01

Document status

Version	Purpose of document	Authored by	Reviewed by	Approved by	Review date
S5.P01	Issue for Planning	TR/UM	PC/BC	PC/BC	27/02/25

Approval for issue

PC/BC	27 February 2025

Prepared by:	Prepared for:
RPS	Laois County Council

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11 WATER

11.1 Introduction

This chapter of the Environmental Impact Assessment Report (EIAR) identifies, describes, and presents an assessment of the likely significant effects of the proposed Clonaslee 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 physicochemical and hydromorphological characteristics of surface waters, drainage and flood risk. Mitigation and monitoring measures to limit potential significant impacts are set out where appropriate.

A full description of the Proposed Scheme including the construction methodology are detailed in within **Chapter 5 – Project Description.**

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

- **Chapter 7 – Population**: impact on recreational users of Water;
- **Chapter 9 – Biodiversity**: Aquatic Ecology: impacts on aquatic ecology; and
- **Chapter 10 – Land, Soils, Geology and Hydrogeology**: hydrogeological and groundwater impacts.

This chapter should be read in conjunction with the Stage 1 – Appropriate Assessment Screening and Stage 2 – Natural Impact Statement for the Proposed Scheme 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). This chapter should also be read in conjunction with **Appendix 11-1 Water Framework Directive Compliance Report.**

11.2 Methodology

This section outlines the legislation and guidelines that informed the composition of this chapter and the methodology used in undertaking the assessment.

11.2.1 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, April 2018) and the 3rd cycle RBMP 2022-2027 (DHLH, September 2024), also referred to as Water Action Plan 2024, which sets out the measures necessary to protect and restore water quality in Ireland.
- Laois County Development Plan 2021-2027 including the SFRA (strategic flood risk assessment).

Guidance

- OPW (2019) Climate Change Sectoral Adaptation Plan, Flood Risk Management
- IFI (2016) Guidelines on protection of fisheries during construction works in and adjacent to waters
- DoEHLG (2009) The Planning System and Flood Risk Assessment Guidelines for the Planning Authorities
- NRA (2008) Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes

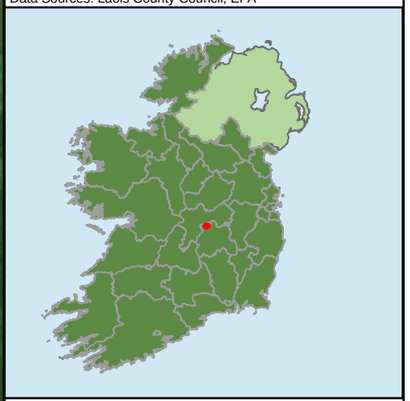
11.2.2 Zone of Influence

The Zone of Influence (ZoI) consists of a 250m-wide corridor either side of the Proposed Scheme boundary as recommended by the 2008 NRA Guidelines. The full Study Area included in the baseline description extends to potentially hydrologically connected points in the wider WFD sub-catchments, shown in **Figure 11-1**. The flood risk impact assessment considers areas within 1km upstream and downstream of the Proposed Scheme on the River.

Legend

- Works Area
- 250m buffer
- WFD Watercourses

Data Sources: Laois County Council, EPA



Client

Laois County Council

Clonaslee FRS

Title

Figure 11-1 Watercourses Study Area

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Issue Details

File Identifier:
MDW0867-RPS-AP-XX-R-EN-1201

Status:	**Rev:**	**Model File Identifier:**
S1	P02	
Drawn: PK		**Date:** 30/09/2024
Checked: DA		**Scale:** 1:10,000 (A3)
Approved: TK		**Projection:** ITM

NOTE:

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11.2.3 Sources of Information to Inform the Assessment

Information on hydrological receptors within the study area was collected in February 2024 through a detailed desktop review of existing studies and datasets as summarised in **Table 11-1**.

Table 11-1 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: – OPW Preliminary Flood Risk Assessment predicted flood maps. – OPW Catchment Flood Risk Assessment Management (CFRAM) Study predicted flood maps. – Hydrology Report (MDW0867RP0012) – Hydraulics Report (MDW0867RP0013)	www.floodinfo.ie
Ordnance Survey Ireland aerial photographs and historical mapping	https://www.osi.ie/
Historic rainfall and evapotranspiration data	www.met.ie
Discharge licence reports	www.epa.ie/licensing
OPW Hydrological Data	https://waterlevel.ie/hydro-data/

11.2.4 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:

- Surface Water Quality (WQ);
- Drinking Water Resources (DWR);
- Flood Risk (FR); and
- Fluvial Geomorphology (FG).

An overview of potential impacts considered in relation to the above parameters during the construction and operational phases is contained in **Table 11-2**.

Table 11-2 Potential Impacts Considered in Assessment

Parameter	Phase*		Potential impact
	C	O	
WQ	✓		Construction activities along the Proposed Scheme may increase the risk of sediment discharge to watercourses
WQ		✓	Increased contaminated run-off discharging to surface waters from the Proposed Scheme
WQ	✓	✓	Impact to operation of the Integrated Constructed Wetland Wastewater Treatment Plant
WQ	✓	✓	Impact to watercourses due to accidental spillages of chemicals/fuel
DWR	✓	✓	Increased risk of contaminants entering the water abstraction borehole sources for drinking water for Clonaslee and Tullamore Town
WQ, FR	✓		Obstruction and contamination of floodwaters during excavation works
FR	✓	✓	Obstruction of surface drainage (overland flows) by the proposed development
FR	✓	✓	Removal of flood storage as a result of the temporary and permanent works encroaching on the floodplain area
FR		✓	Increased flood risk upstream and downstream of the proposed scheme area
FR, FG	✓		Obstruction to river flow within watercourses during excavation works at the proposed Debris Trap including temporary storage of materials
FG	✓	✓	Changes to sediment transport regime – as a result of construction of Debris Trap
FG	✓	✓	Scouring of the riverbed
FG		✓	Detriment to the Hydromorphology of the watercourses

**C = Construction, O = Operation*

11.2.5 Assessment Criteria and Significance

The method 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.

Impacts may be categorised as one of three types:

- **Direct Impact** - the existing hydrological environment along, or in close proximity to, the Proposed Development is altered, in whole or in part, as a consequence of construction and/or operation of the proposed scheme.
- **Indirect Impact** - the hydrological environment beyond the Proposed Development is altered by activities related to the FRS construction and/or operation.
- **No Predicted Impact** - the Proposed Development has neither a negative nor a positive impact on the hydrological environment.

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 11-3.

Table 11-3: 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 11-4**. These impacts may be positive, neutral, or negative/adverse. The significance of potential impacts is then described in terms of the descriptions adapted from the EPA Guidelines (EPA, 2022) as outlined in **Table 11-5**.

Table 11-4: 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
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 11-5: 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 11-6**. 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 11-6: Matrix used for the Rating of the Significance of Environmental Impact

Importance/ Sensitivity of Attribute	Magnitude of Impact: Negligible	Small	Moderate	Large
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 Water Quality

Water quality records for the watercourses within the proposed development were sourced from the EPA at locations where water quality assessments are carried out as part of the EPA nationwide water monitoring programme. The national rivers monitoring programme is run by the EPA and focuses on the main river channels, rather than smaller streams. The programme includes more than 2,800 sites sampled for biology. Almost half of these are also sampled for physical (e.g., oxygen content) and chemical (e.g., nitrogen and phosphorus) parameters.

The biological monitoring assesses:

- Invertebrates (animals without a backbone, such as mayflies or worms).
- Aquatic plants.
- Diatoms (a type of algae).
- Fish (monitored by Inland Fisheries Ireland).

The physical and chemical parameters measured in the field and laboratory include:

- Dissolved oxygen.
- Nutrients, such as nitrogen and phosphorus.
- Hazardous substances.

- Temperature.
- pH (acidity).

Biology is monitored once every three years, while the physical and chemical parameters are measured several times a year. EPA also monitor river levels and flows continuously and any changes in the physical structure of the river channel are also recorded. A comprehensive report of the EPA survey methods and monitoring programme is provided in Ireland's National Water Framework Directive Monitoring Programme 2019-2021 prepared by the EPA. The Water Framework Directive is referred to hereafter as the WFD.

The monitoring data is used to evaluate habitat quality and instream macroinvertebrate assemblage to interpret ecological status of the water body. The Biotic Index (Q-value) is determined from the macroinvertebrate species present and their relative abundance in a sample. These Biotic Indices are used to determine the WFD Ecological Status as outlined in **Table 11-7**.

Table 11-7: 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	

The main aim of the EU WFD is to achieve good status in both surface and groundwater bodies and the prevention of deterioration in water bodies that are already in good or better status. Surface waters include rivers, lakes, transitional waters, and coastal waters. For natural waters these environmental objectives relate to achieving or maintaining good or high ecological status and good chemical status for surface waters and good chemical and quantitative status for groundwaters. For heavily modified or artificial water bodies which are incapable of achieving good ecological status without impairing an existing specified water use the environmental objective is to achieve good ecological potential.

Further to the above, each waterbody has been designated/identified at different risk categories based on failing/meeting the WFD objectives by 2027. The risk was determined by assessment of monitoring data, data on the pressures and data on the measures that have been implemented.

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.

11.2.7 Flood Risk Assessment Methodology

Flood risk in the area is assessed in accordance with the Government's Guidelines for Planning Authorities "The Planning System and Flood Risk Management Guidelines for Planning Authorities" (DoEHLG, 2009). The guidelines recommend that Flood Risk Assessments (FRA) be carried out to identify the risk of flooding to land, property, and people. FRAs should use the Source- Pathway-Receptor (S-P-R) Model to identify the sources of flooding, the flow paths of the floodwaters and the people and assets impacted by the flooding. The guidelines recommend that FRAs should be carried out using the following staged approach:

- **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 LAPs that may warrant further investigation at the appropriate lower-level plan or planning application levels. This Stage 1 FRA has been completed and identified that there is a potential for future flood risks to the lands and properties located within the Clonaslee Flood Relief Scheme Area (refer to the Hydrology Report for further details on this). Also refer to the OPW Preliminary Flood Risk Assessment Report prepared as part of the CFRAM programme (2012). In this PFRA studies Clonaslee was identified as a possible 'Area for Further Assessment (AFA)'.
- **Stage 2 Initial Flood Risk Assessment** – to confirm sources of flooding that may affect a plan area 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. This Stage 2 FRA has been completed and identified that there is a potential future flood risks to the lands and properties located within the Clonaslee Flood Relief Scheme Area. Refer to the OPW Preliminary Flood Risk Assessment Report prepared as part of the CFRAM programme (2012). In this PFRA studies Clonaslee was identified as a possible 'Area for Further Assessment (AFA)'. Based on this findings, a detailed hydrological and hydraulic modelling studies were carried out on the Clonaslee AFA as part of the Shannon CFRAM Study. The predictive flood extents maps were prepared for this AFA. Also refer to the Hydrology and Hydraulics Reports prepared for this scheme for further details on this.
- **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. In the CFRAM study a Flood Risk Management Plan was identified for this AFA and recommended to implement this plan to protect the lands and properties which are identified to be at significant flood risks with the Clonaslee AFA. Under the Clonaslee FRS a further assessment on these CFRAM study recommended measures were carried out through a detailed hydrological, hydraulic and environmental studies. Refer to the Hydrology and Hydraulics Reports prepared for this scheme for further details on this.

The guidelines recommend identifying flood zones which show the extent of flooding for a range flood event probability. The 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 1000 for both river and coastal flooding). Flood Zone C covers all areas of the plan which are not in zones A or B.

In additional to the above, the OPW recommended guidelines on applying for consents for the Construction, Replacement or Alterations of Bridges and Culverts under Section 50 of the Arterial Drainage Act, 1945 have also been followed.

Information gathered during the constraints and option selection stages of the project have been used in assessing the flood risks. Various sources of hydrological information, as listed in **Table 11-4,** have been used in the assessment.

The design flood flows for the proposed flood relief scheme have been estimated in accordance with the Flood Studies Report (NERC, 1975) and Flood Studies Update (FSU, OPW,2012) recommended methodologies. Appropriate allowances to cater for the future climate change impacts have been applied to the design flow estimates, as set out in the 'Climate Change Sectoral Adaptation Plan, Flood Risk Management' (OPW, Sept. 2019).

Any potential impacts on the existing flooding regimes likely to be caused by the Proposed Scheme have been assessed through hydraulic modelling of the relevant river/stream channels. Appropriate remedial measures have been adopted in the proposed designs to minimise any predicted impacts.

11.2.8 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.

11.2.9 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. **Chapter 3 Consultation** also provides details on the types of consultation activities undertaken for the proposed scheme and consultees that were contacted.

Consultations relevant to water and drainage were undertaken with the following stakeholders:

- Laois County Council
- OPW
- IFI
- Uisce Éireann (UÉ)

Where responses were received these are summarised in **Table 11-8** below.

Table 11-8: List of Consultations

Consultee	Feedback		Location where comments were addressed
Inland Fisheries Ireland (IFI); Responses received on 9th January 2024.	1.	The aquatic habitat and physical nature of any watercourse affected by the development must be fully described in detail. This includes areas of open water, pool riffle glide sequences, density and types of aquatic vegetation, description of riparian zones to depth of at least 10 metres on either bank etc. The extent of the surveys should be sufficiently long enough so as to be representative of the habitat contained in that watercourse. There should be a particular focus on sections upstream and downstream of any point where an impact on the watercourse is likely to arise.	Aquatic ecology surveys have been undertaken. The relevant survey data are presented in Section 9.3.5 of Chapter 9: Biodiversity.
	2.	Please also note that any instream works or other works which may impact directly on a watercourse should only be carried out during the open season which is from 1st July to 30th of September in each year (so as to avoid impacting on the aquatic habitat during the spawning season.) It would be important that appropriate scheduling of works is allowed for.	Mitigation measures associated with the surface water quality during the construction phase are outlined in Section 11.5.1. Also refer to Section 9.6.6 in Chapter 9: Biodiversity.
	3.	The EIAR should indicate proposals to monitor the impact on watercourses within the site. In the event that environmental damage to the aquatic habitat and associated riparian zone is caused, the EIAR should indicate the steps that may be taken to rectify any damage to the aquatic habitat including liaison with the appropriate authorities.	Proposals for monitoring any potential impacts on water quality both during the construction and operation phases of the works are provided in Section 11.7 and in Section 9.8 in Chapter 9: Biodiversity
	4.	Dewatering may require fish removal and translocation and will require a Section 14 licence from IFI.	Addressed in Section 9.6.7 in Chapter 9: Biodiversity
	5.	In relation to the prosed debris trap, IFI would like more information on this novel structure, including more information on the efficacy of the structure referred to in the UK and the one approved as part of the Whitechurch FRS. An assessment shall also be made on the impact of loss of potential spawning habitat at this location and any changes to the flow regime and its impact on sediment deposition or erosion. The responsibility for the trap maintenance shall also be defined.	See Chapter 5: Project Description regarding the efficacy of the structure. The potential impacts of this structure on the hydrology attributes are provided in Section 11.4.2.3 and Section 11.4.2.4. Also refer to Section 9.5.2 in Chapter 9: Biodiversity.
	6.	Hydromorphology of rivers is one the key tenets for defining the ecological status of rivers under the Water Framework Directive,	Potential impacts on the existing hydromorphology of rivers,

Consultee	Feedback	Location where comments were addressed
	where a deterioration due to hydromorphology will lead to a status change in a river. River continuity is one of the quality elements in such assessment. It is the strong preference of IFI that any weir removal is not ruled out at this stage and should be scoped as part of the final project design. IFI have completed SNIFFER protocol assessments of the weirs in Clonaslee,	particularly in Clodiagh River in the vicinity of the proposed Debris Trap are discussed in 11.4.2.4. Mitigations measures are provided in Section 11.5. Potential benefits to flood management of weir removal are discussed in Chapter 4: Consideration of Alternatives
	7. IFI have also been liaising with the OPW in relation to mitigation works at the sand trap. The discharge of polluting or deleterious matter to any watercourse except under and in accordance with a licence may be an offense under the Fisheries Acts and/or under the Water Pollution Acts. Should works be approved a finalised CEMP must be agreed with Inland Fisheries Ireland before works commence.	A site-specific CEMP has been prepared as part of this EIAR which will be further updated by the contractor prior to the commencement of any works in order to ensure all works are carried out in a manner designed to avoid and minimise any adverse impacts on the receiving environment.
Uisce Éireann (UÉ)	1. The applicant shall sign a connection agreement with Uisce Éireann prior to the commencement of the development and adhere to the standards and conditions set out in that agreement. 2. All development shall be carried out in compliance with Uisce Éireann Standards codes and practices. 3. Any proposals by the applicant to divert or build over existing water or wastewater services shall be submitted to Uisce Éireann for written approval prior to works commencing. 4. Separation distances between the existing Uisce Éireann assets and proposed structures, other services, trees, etc. have to be in accordance with the Irish Water Codes of Practice and Standard Details.	See Chapter 15: Material Assets and Utilities, where these comments are addressed.

11.3 Description of the Existing Environment

11.3.1 Existing Environment

11.3.1.1 Watercourses Catchments

The Proposed Scheme is located in Clonaslee, Co. Laois, which is in the upper reaches of the Lower Shannon Catchment (Hydrometric Area 25, WFD ID 25A). The catchment (hydrometric area) covers an area of 1,248 km^2 and is characterised by relatively flat topography with much of the low-lying areas in the catchment covered in thick deposits of peat. The Clonaslee town sits within the CLODIAGH[TULLAMORE]_SC_010 sub-catchment (WFD ID 25A_6) which drains an area of approximately 27km^2 upstream of the Clonaslee FRS Scheme Study Area.

The Clodiagh River and the Gorragh River pass through the Study Area. Downstream of the Study Area, the Gorragh River joins the Clodiagh River. The Clodiagh River then continues its flow in a northward direction until it meets the Brosna River at Derrynagun, Co. Offaly. The individual watercourses are discussed further in the subsections further below. **Figure 11-2** shows the Clodiagh and Gorragh river catchments extents upstream of the proposed works.. Also **Figure 11-3** shows an overview of all watercourses in the vicinity of the study area.

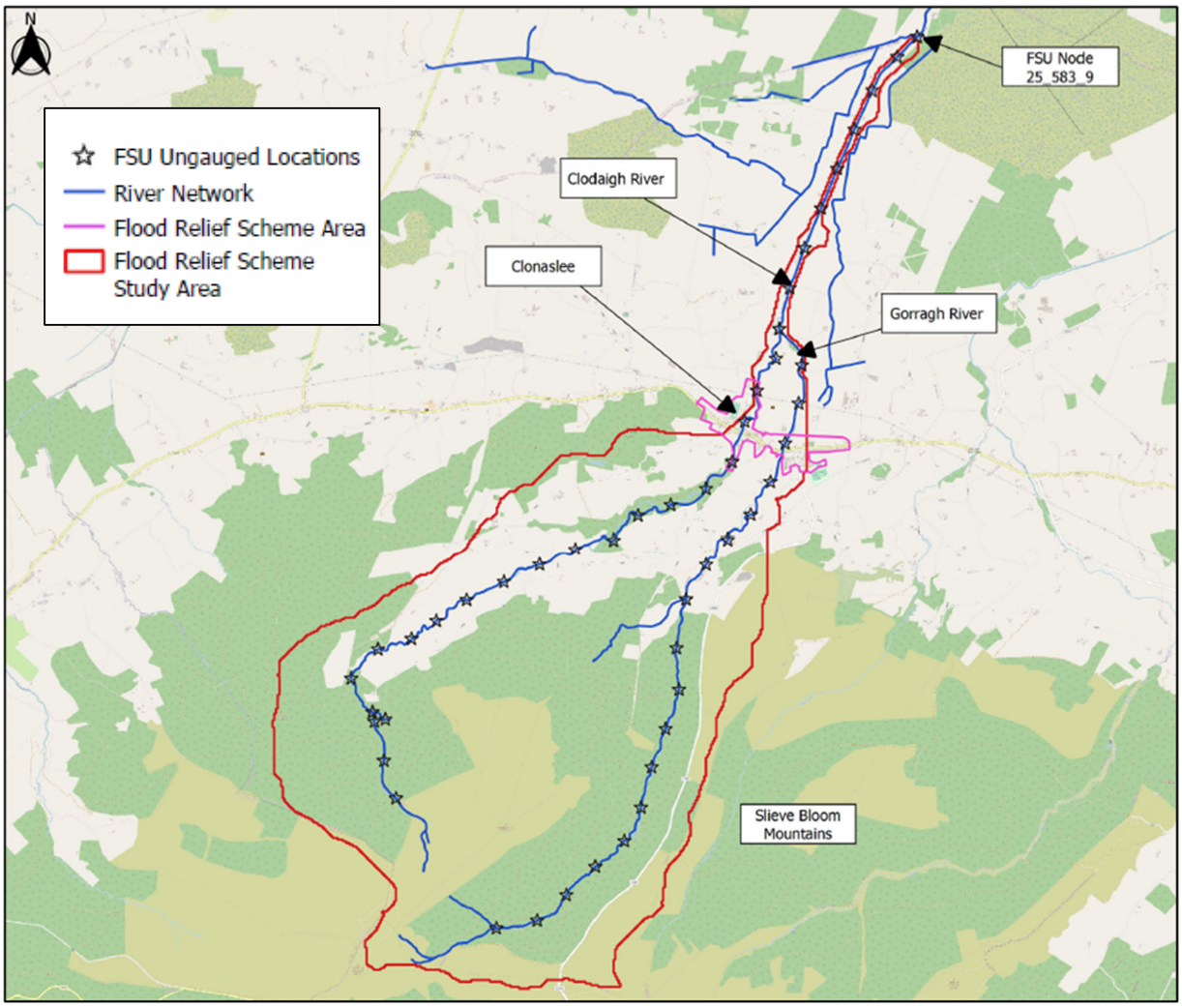

Figure 11-2 Clodiagh and Gorragh Rivers Catchment

11.3.1.1.1 Clodiagh River

The Clodiagh River rises from Glenkeen Upper region near Knockachorra mountain in Co. Laois. It flows northward to pass through Clonaslee and flows further northward to meet River Brosna.

The section of the Clodiagh river within the study area is coded by the EPA for the purposes of WFD reporting as the Clodiagh (Tullamore)_010 river waterbody (EPA code IE_SH_ 25C060220). This terminates at the merger point of Gorragh river, whereafter the watercourse becomes the Clodiagh (Tullamore)_020 (EPA code IE_ SH_ 25C060300).

11.3.1.1.2 Gorragh River

Gorragh river rises from Glenkeen Upper region near Wolftrap mountain in Co. Laois. It flows northward to pass through Clonaslee to meet Clodiagh river north of the village.

The section of the Gorragh river within the study area is coded by the EPA for the purposes of WFD reporting as the Gorragh_010 river waterbody (EPA code IE_SH_ 25G090300).

Table 11-9 shows the catchment characteristics from the OPW FSU database for the Clodiagh and Gorragh Rivers at Clonaslee. It can be seen that the study area is steep, with a large annual rainfall (1490mm) and a low value of Soil baseflow index (BFIsoil). The characteristics for the study area agree with the topographical

and geological nature of the surrounding area, as Clonaslee is at the base of the northern slopes of Slieve Bloom Mountains. The upstream area is underlain by peaty soils with low permeability (Source: Geological Survey Ireland Spatial Resources Online Viewer) indicating that the study area is susceptible to flash floods.

Table 11-9 Catchment Descriptors (Rivers Clodiagh and Gorragh)

Catchment	Area (km^2)	BFISOIL	SAAR (mm)	FARL	DRAIND (km/km2)	S1085 (m/km)	ARTDRAIN2 (%)	URBEXT (%)	$Q_{med-rural}$ (m^3/s)
Rivers Clodiagh and Gorragh (FSU Node 25_583_9	27.038	0.342	1484	1	1.025	16.449	22.06	0.011	18.612

Legend

- Works Area
- 250m buffer
- WFD Watercourses

Data Sources: Laois County Council, EPA

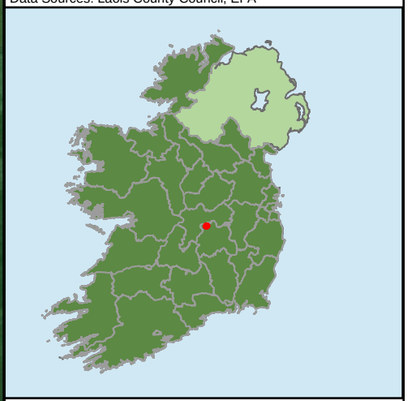

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Figure 11-3 Watercourses Study Area

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File Identifier:
MDW0867-RPS-AP-XX-R-EN-1201

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S1	P02	
Drawn: PK		**Date:** 30/09/2024
Checked: DA		**Scale:** 1:10,000 (A3)
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11.3.1.2 Water Quality

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 11-10** (also see **Figure 11-4** and **Figure 11-5**). According to this assessment the ecological status and risks for both the Clodiagh and Gorragh river segments within the study area have been assessed as "Good" and "Not at Risk" respectively. The Second Cycle WFD data, based on monitoring data from 2010-2015, is also included for reference. The WFD status and risk of the groundwater bodies in the catchment is good and not at risk respectively.

Table 11-10 EPA WFD Status and Risk

Water Body	Second WFD Cycle (2010-2015)		Third WFD Cycle (2016-2021)	
	Status	Risk	Status	Risk
Clodiagh (Tullamore)_010	Good	Not at Risk	Good	Not at Risk
Gorragh_010	High	Not at Risk	Good	Not at Risk

The water quality sampling locations within the subject river catchments are shown **in Figure 11-6**. The reported Q-values for the Clodiagh and Gorragh rivers, along with the most recent year of assessment, are presented in **Table 11-11.** The assigned Q-values for the Clodiagh and Gorragh rivers range from 4 to 5, which suggest that the subject river waters are unpolluted.

Table 11-11 EPA Q-Values

Watercourses	Station Code	Year	Q-Value	Status
Clodiagh (Tullamore)_010	RS25C060100	2023	4-5	High
	RS25C060090	2021	4	Good
	RS25C060220	2023	4	Good
	RS25C060050	2023	4	Good
Gorragh_010	RS25G090300	2023	5	High
	RS25G090200	2023	5	High

WFD Rivers
Good
High
Moderate
Poor
WFD Canals
Good
WFD Ground Waterbodies
Good

CLODIAGH (TULLAMORE)_050
CLODIAGH (TULLAMORE)_040
CLODIAGH (TULLAMORE)_030
CLODIAGH (TULLAMORE)_020
CLODIAGH (TULLAMORE)_010

Clonaslee
R422
167 m

Legend

- WFD Catchment
- Clonaslee FRS 500m Corridor
- WFD Watercourses
- Works Area

Data Sources: Laois County Council, EPA

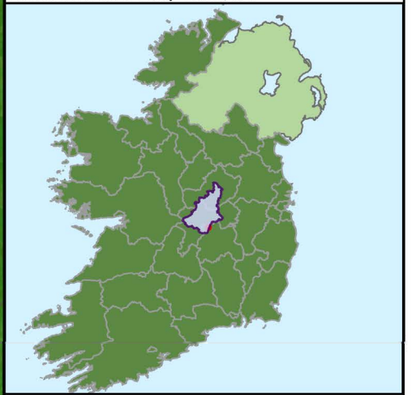

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Figure 11-4
WFD Ecological Status

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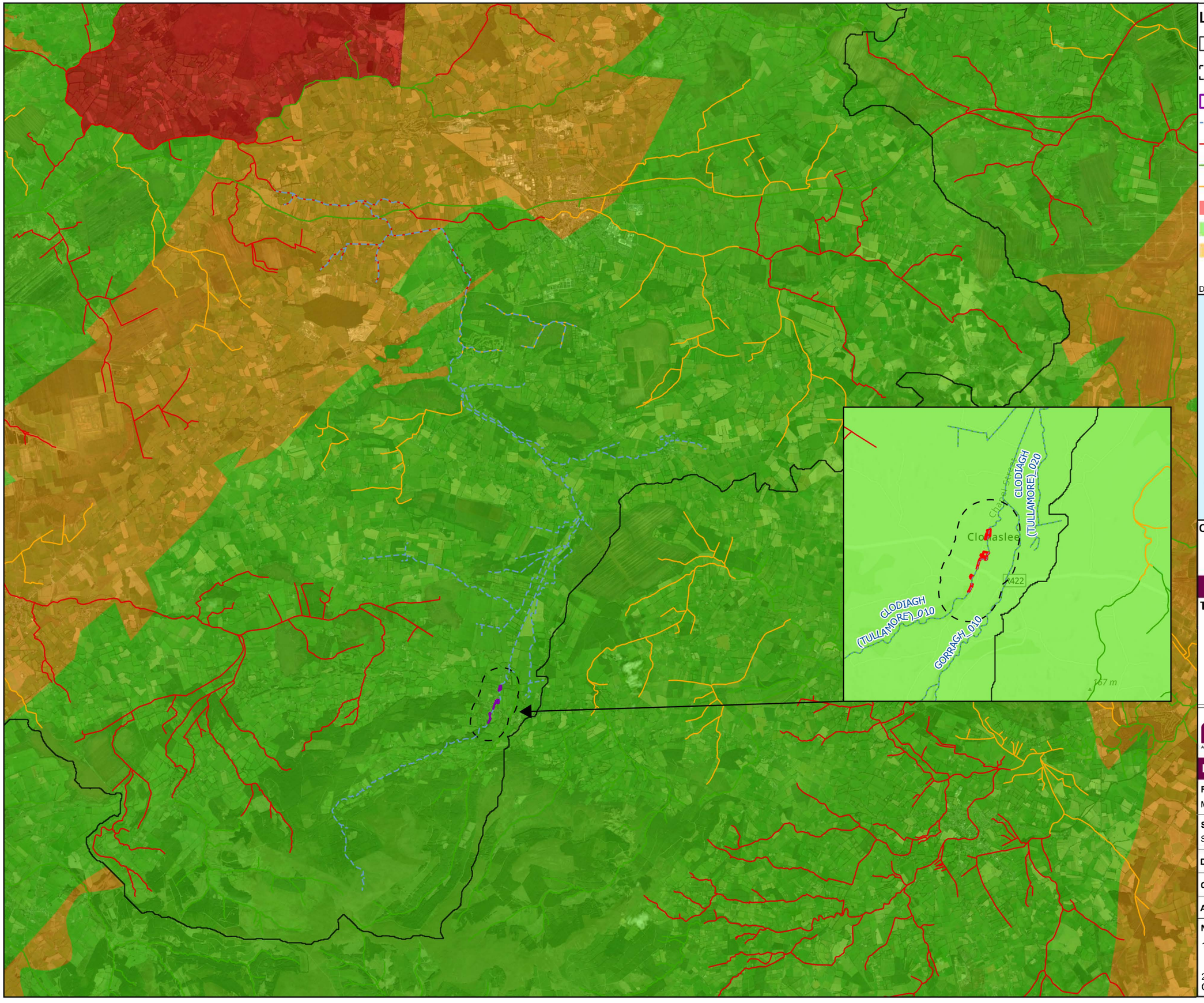

Legend

- WFD Catchment
- Clonaslee FRS 500m Corridor
- Works Area
- WFD Watercourses
- At risk
- Not at risk
- Review
- At risk
- Not at risk
- Review

Data Sources: Laois County Council, EPA

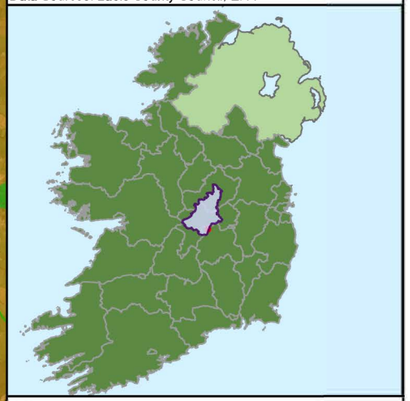

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Figure 11-5
WFD Waterbody Risk

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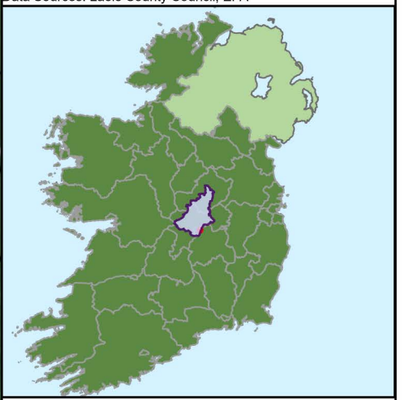
Legend

- Works Area
- Clonaslee FRS 500m Corridor
- Water Quality Sampling Locations
- WFD Watercourses

Data Sources: Laois County Council, EPA



Client

Laois County Council

Clonaslee FRS

Title

Figure 11-6 Water Quality Sampling Locations

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11.3.1.2.1 Water Supply Sources

In the proposed development area, there exist multiple locations where groundwater is being extracted. (see **Figure 11-8 and Figure 11-9**). These include the abstraction point for supply of potable water to the town of Tullamore. A supply of raw water to a distillery in Tullamore is also sourced in the Study Area. Further details of these groundwater abstraction sources are provided in **Chapter 10: Land, Soils, Geology and Hydrogeology** (ref. Section 10.3.14.2).

Legend

- Clonaslee FRS 500m Corridor
- Groundwater Wells Springs
- WFD Watercourses
- Works Area

Data Sources: Laois County Council, EPA

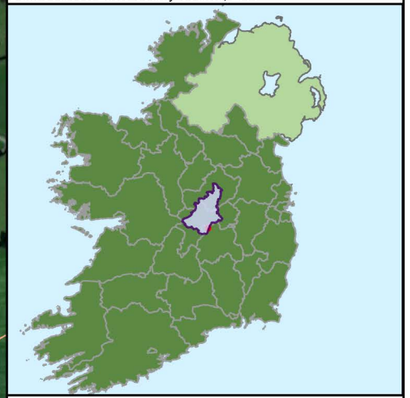

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Figure 11-7 Groundwater Wells and Springs

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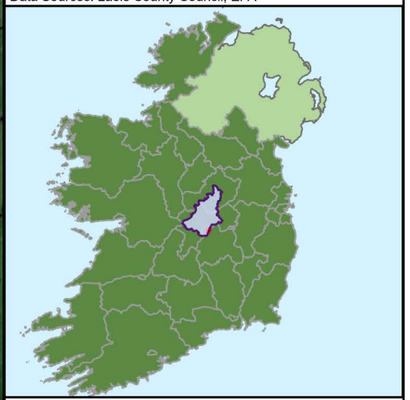
Legend

- Works Area
- Clonaslee FRS 500m Corridor

Wastewater Treatment Plant Locations

- Undefined
- Fail
- Pass
- IEL Licensed facilities
- IPC Licensed facilities
- Wastewater agglomerations

Data Sources: Laois County Council, EPA



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Clonaslee FRS

Title

Figure 11-8 Wastewater Treatment Plant Locations

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11.3.1.2.2 Wastewater Treatment Plants

Figure 11-10 above illustrates the locations of Wastewater Treatment Plants (WWTP), Wastewater agglomerations, IPC and IEL licensed facilities located in the surrounding area. Wastewater for Clonaslee is treated through an Integrated Constructed Wetland (ICW), which was constructed in 2011 and is maintained by Uisce Éireann. **Figure 11-9** shows the extent of this wetland area.

Figure 11-9: Extent of the Clonaslee Wastewater Treatment Constructed Wetland

11.3.1.3 Water-dependent Ecological Receptors

An overview of Special Areas of Conservation (SACs) and Special Protection Areas (SPAs) potentially associated with the Proposed Scheme is provided in **Figure 11-11**. Charleville Wood SAC is located 13 km downstream of the village and has direct hydrological connectivity to the Scheme area. Three SACs are known to have hydrogeological connectivity: notably Clonaslee Eskers and Derry Bog SAC; River Barrow and River Nore SAC; and Slieve Bloom Mountain SAC.

With regards to SPAs, a conservative 30 km buffer area was selected as a preliminary search area, owing to the presence of Whooper swan. Whooper swan are a species that is known to roam between a number of SPAs and suitable wetland features surrounding the constraints study area, up to distances of approximately 30 km.

Within this buffer, five SPAs were identified:

- All Saints Bog SPA
- Dovegrove Callows SPA
- River Little Brosna Callows SPA
- Middle Shannon Callows SPA
- Slieve Bloom Mountains SPA

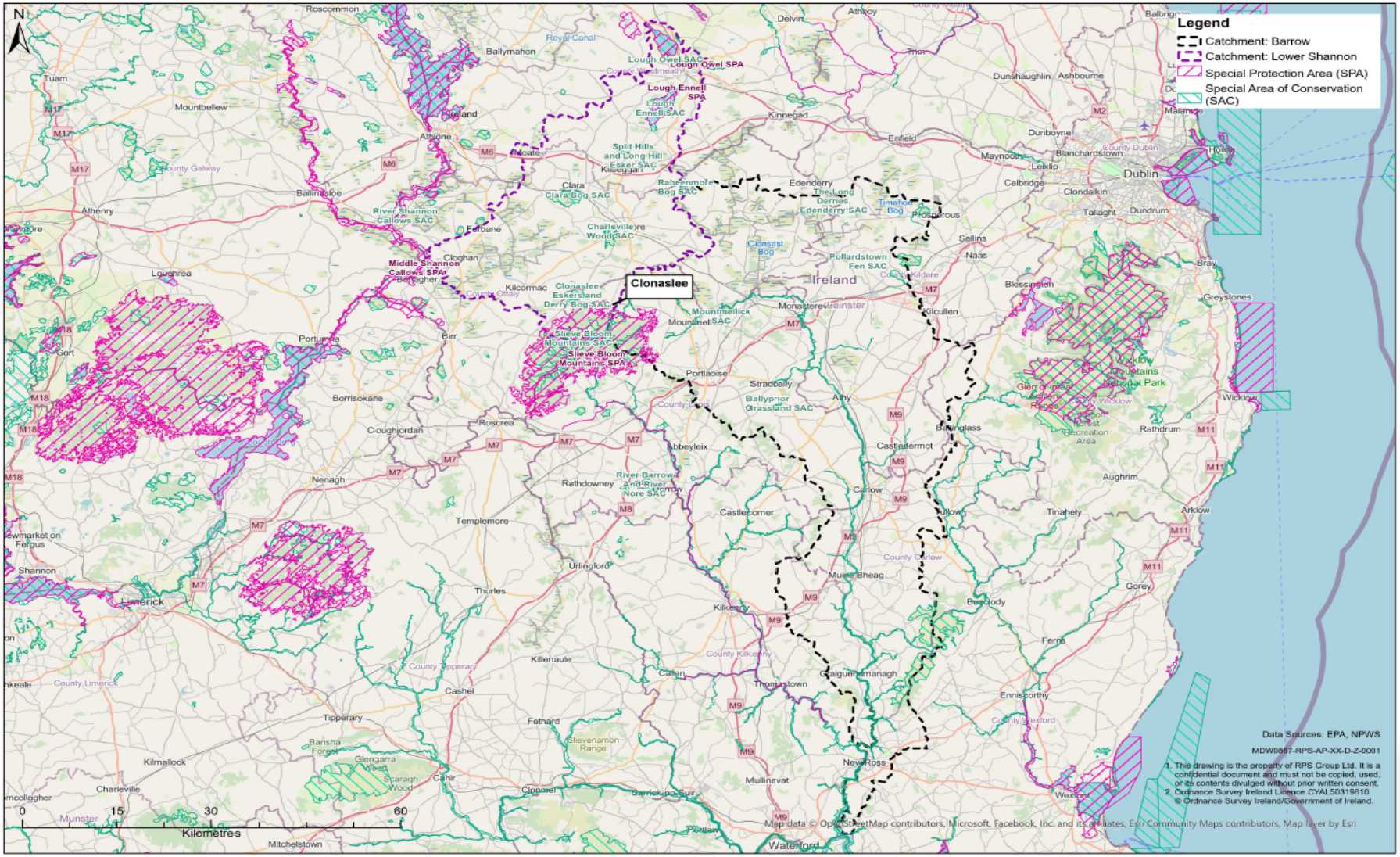


Figure 11-10: European Designated Sites (SACs and SPAs)

11.3.1.4 Flood risk identification

11.3.1.4.1 Existing Surface Water Drainage

Arterial Drainage Schemes were carried out under the Arterial Drainage Act 1945, to improve drainage for agricultural lands and reduce the risk of flooding. Rivers, lakes, weirs, and bridges were all modified to improve conveyance and embankments were built to control the movement of flood water. Flood protection in the benefiting lands was increased as a result of the Arterial Drainage Schemes.

The river Brosna was the first scheme to be undertaken and it commenced in 1947. The OPW is required to maintain Arterial Drainage schemes under sections 37 and 38 of the Arterial Drainage Act, 1945. The Act was amended on a number of occasions, e.g., to transpose EU Regulations and Directives such as the EIA, SEA, and Habitats Directives and the Aarhus Convention. **Figure 11-12** shows the channels and embankments along the River Gorragh and River Clodiagh that are maintained by the OPW as part of the River Brosna Arterial Drainage Scheme.

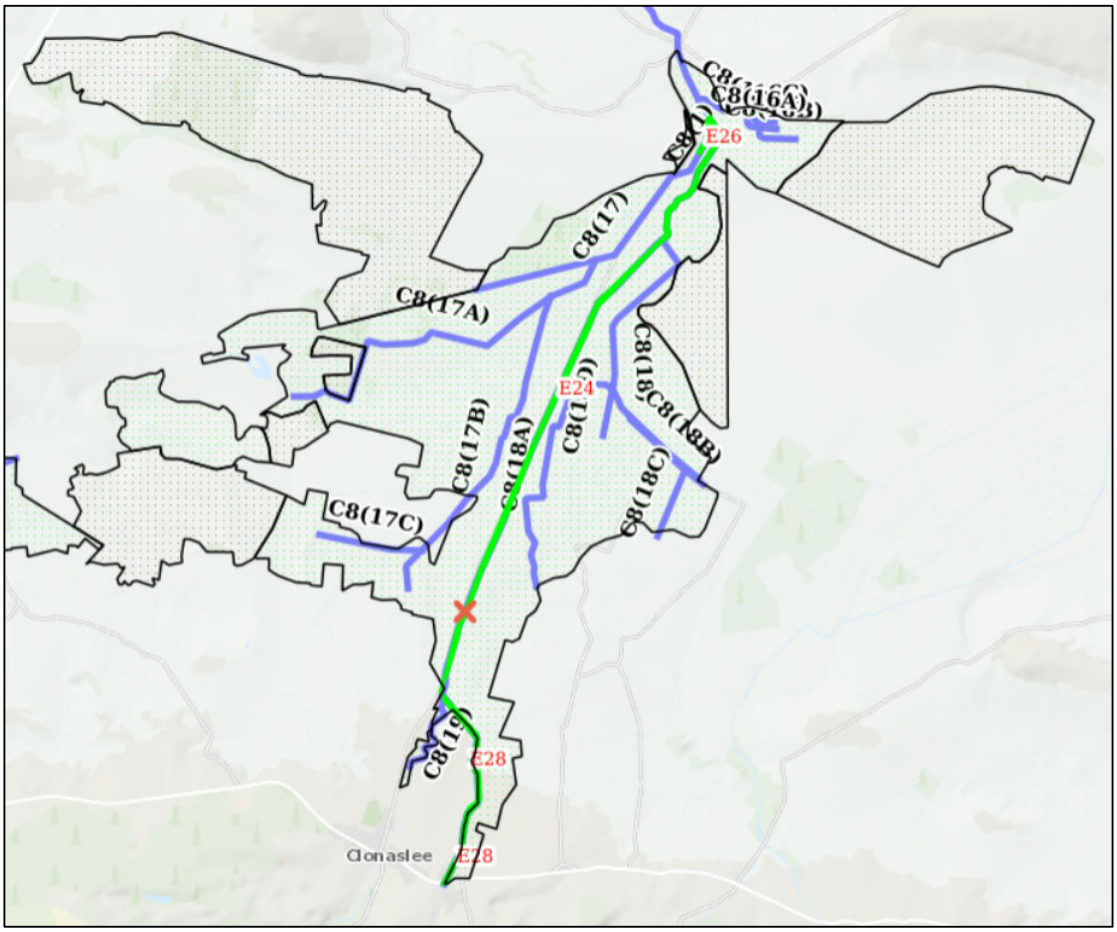


Figure 11-11: Channels (purple) and Embankments (green) along the River Gorragh and River Clodiagh[1]

11.3.1.4.2 Flooding History

The latest and best record of flooding in Clonaslee occurred is from 21st/22nd November 2017. In that event, the Clodiagh River burst its banks and flooded Chapel St in the village. There was also widespread flooding in the region on the same day impacting local roads and the town of Mountmellick. A review of the daily rain gauge data at the Clonaslee Water Treatment Plant (St. No. 522) and of water level recorder at Bracknagh

[1] floodinfo.ie

Bridge (St. No. 25301) indicated that the flood event was in the top 10 of recorded events of rainfall and water level (**Table 11-12).**

Table 11-12 Maximum Daily Rainfall at the Clonaslee Water Treatment Plant (St No. 522) and Water Level at Bracknagh Bridge (St. No. 25301)

Date	Daily Rainfall (mm)	Date	Water Level mOD (Malin)	Rank
01/08/2014	95.0	09/02/2020	86.285	1
05/09/2010	73.3	16/08/2008	86.282	2
07/06/2012	68.4	04/06/2019	86.18	3
04/06/2019	64.6	08/06/2012	86.167	4
29/12/2013	62.1	06/09/2010	86.16	5
21/11/2017	*50.2*	16/07/2010	86.142	6
22/06/2004	48.2	09/08/2008	86.137	7
21/05/2006	47.5	08/11/2010	86.12	8
13/11/2014	47.0	22/11/2017	86.107	9
08/02/2020	46.3	07/11/2010	86.098	10

Local media reports and consultation with the public and Laois County Council indicated that flooding occurred due to the high river levels coinciding with a breach in a masonry wall along the riverbank. The structural integrity of the wall had been compromised in a traffic collision less than two weeks previous. Flood waters breached through the wall collapse, as shown in **Image 11-1,** inundating several properties adjacent to the river in the village of Clonaslee.

Image 11-1 Flooding at Clonaslee: November 2017[2]

Anecdotal evidence gathered through public consultation also indicates that flooding events also occurred in 1967/68, August 2008 and 2013. Flooding in August 2008 also occurred nationally as well as impacting other areas within Co. Laois including nearby Mountmellick.

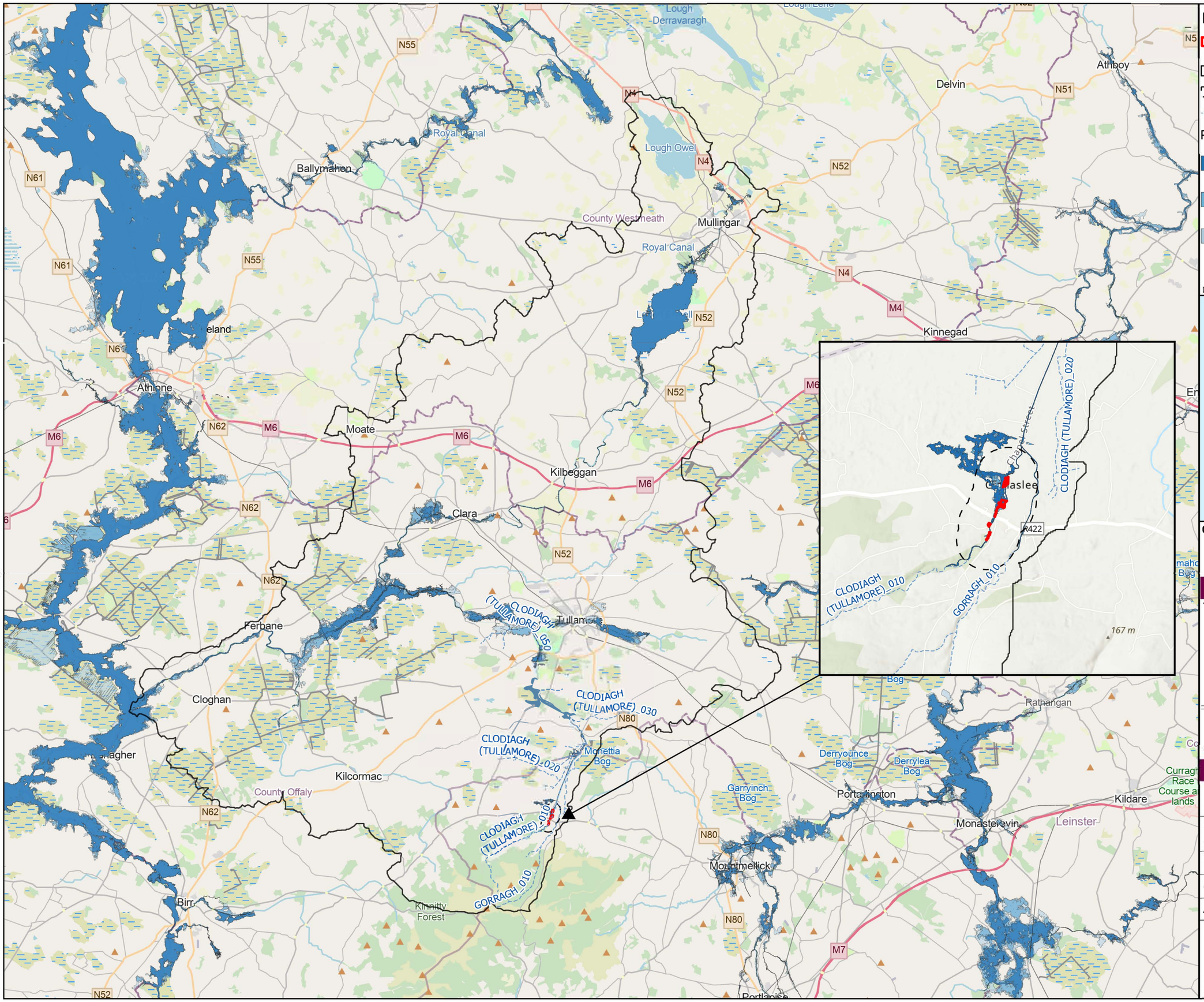
11.3.1.4.3 Predicted Flooding

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

Under the Southeastern CFRAM study the Clodiagh and Gorragh River channels were modelled and flood extents map was prepared. **Figure 11-13** shows an extract of this flood map, which shows some flooding at Clonaslee, particularly from the high-water levels in Clodiagh River.

The Geological Survey of Ireland (GSI), prepared surface water flood maps prepared for the Winter 2015/2016 flood events, show some evidence of historic surface water flooding within the study area, particularly in the northern vicinity of the scheme area. The GSI prepared predictive groundwater flood maps do not indicate a flood risk from groundwater within the study area (source: www.floodinfo.ie).

[2] Independent.ie



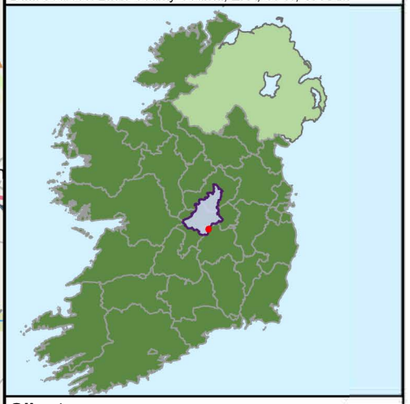
Legend

- Clonaslee FRS Red Line Boundary
- WFD Catchment
- Clonaslee FRS 500m Corridor
- Rivers

River Flood Extents

- River Flood Extents - Present Day - High Probability
- River Flood Extents - Present Day - Medium Probability
- River Flood Extents - Present Day - Low Probability

Data Sources: Laois County Council, EPA, OPW, CFRAM



Client

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Figure 11-12 CFRAM Study Predicted Flood Extents

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File Identifier:
MDW0867-RPS-AP-XX-R-EN-1209

Status:	Rev:	Model File Identifier:
S1	P01	
Drawn: PK		Date: 09/04/2024
Checked: DA		Scale: 1:250,000 (A3)
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11.3.1.4.3.2 County Laois Strategic Flood Risk Assessment (SFRA)

JBA Consulting was commissioned by Laois County Council (LCC) to provide assistance in the preparation of the Strategic Flood Risk Assessment (SFRA)[3] to inform the Laois County Development Plan 2021-2027 (LCDP). The data used for the development of flood zone map are from the Southeastern CFRAM Study. In this SFRA, much of the proposed Clonaslee scheme area have been assessed as at Flood Risk Zone of A Flood Risk Zone of B. (see **Figure 11-14**).

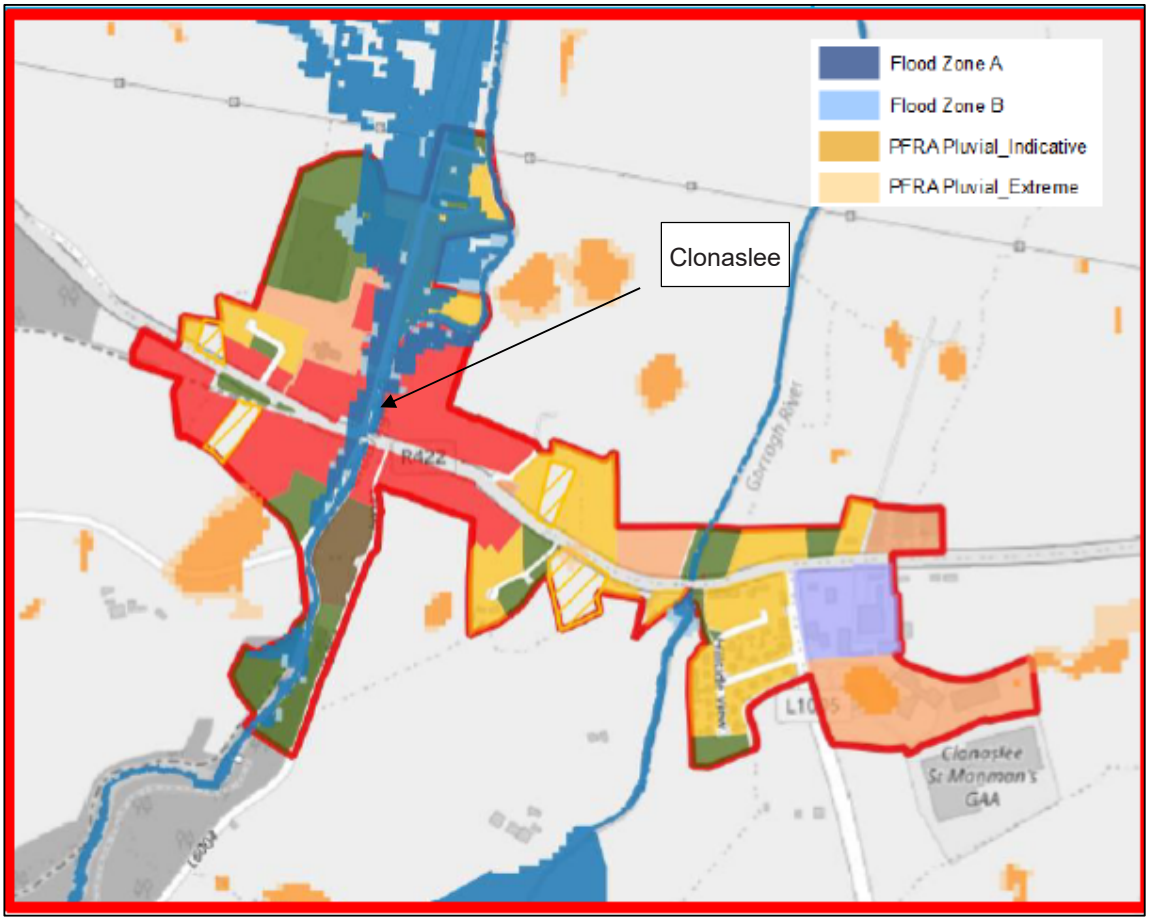

Figure 11-13 Flood Zone Map (County Laois Strategic Flood Risk Assessment (SFRA))

11.3.1.4.3.3 Clonaslee FRS Flood Model Predictions

As part of the Clonaslee FRS, a more detailed analysis was carried out at the local level to achieve an improved understanding of the flooding mechanisms. Flood maps were derived from this detailed modelling and are presented below.

Do Nothing Scenario

This model run is the best representation of the 1% AEP event if it occurred in the present-day scenario. A key assumption for this model is that two informal flood defences, namely the existing wall on Chapel Street and an embankment upstream of the ICW access bridge, remain intact and act as flood defences. Anecdotal evidence confirms that this would generally be the case so this Scenario forms our Baseline from the EIA point of view. The existing wall and embankment however, cannot be relied upon indefinitely, and must be replaced to deliver flood protection to the village. The significant flood of 2017 occurred as a result of a storm event coinciding with a breach in the wall due to a vehicle collision.

[3] County Laois Strategic Flood Risk Assessment

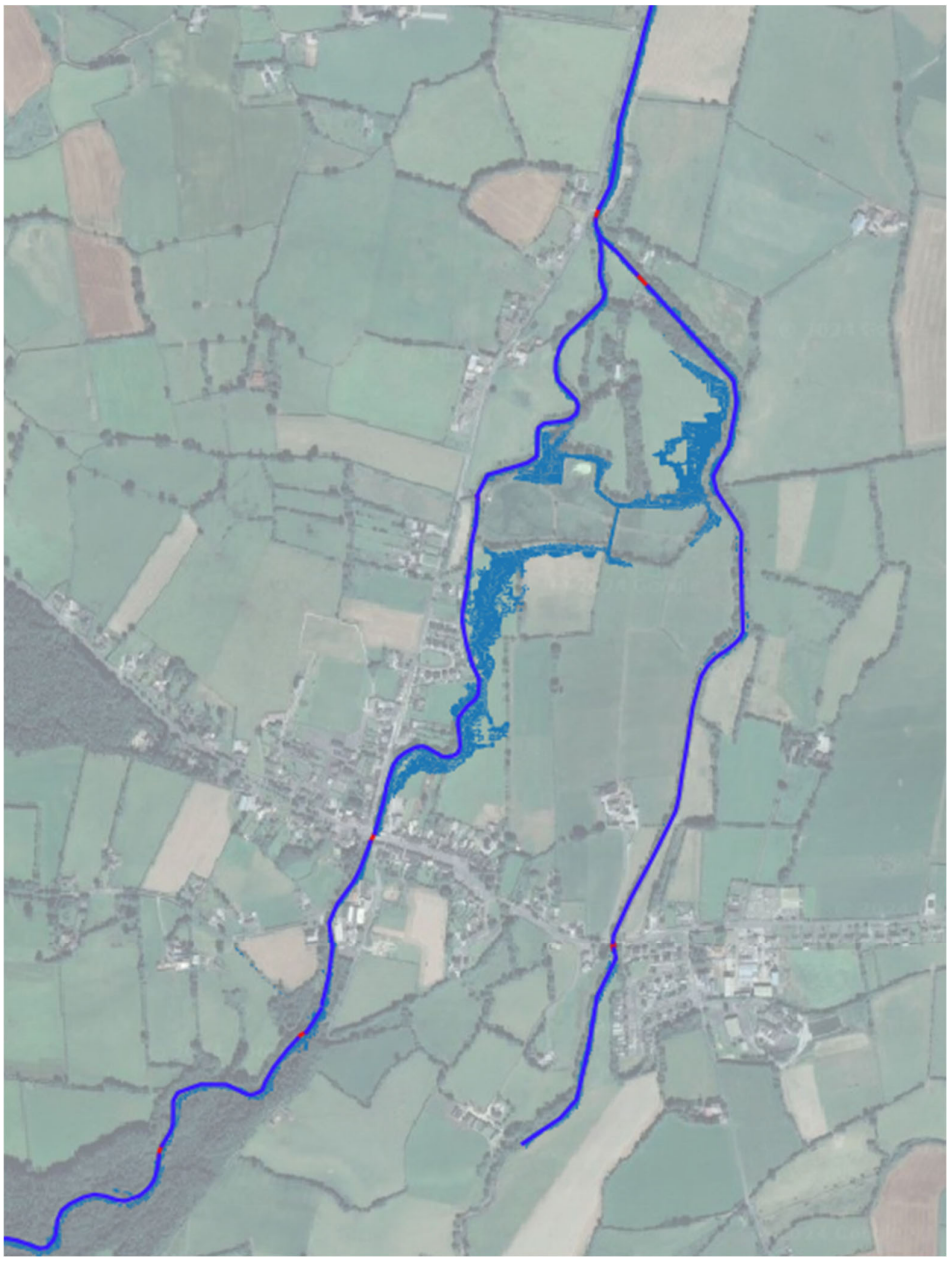

Figure 11-14 1% AEP Model Predicted flooding in Present Day Do Nothing Scenario

The as-built topography of the Uisce Éireann Integrated Constructed Wetlands (ICW) Wastewater Treatment Plant has been reflected in the Digital Terrain Model (DTM) within this Hydraulic Model. The ICW's treatment 'cells' are surrounded by embankments. A pre-existing field drain was retained and enlarged during construction of the ICW. We can from the above that the treatment cells of the ICW are not predicted to flood, and the drain is sufficiently sized to convey floodwater through the ICW from south to north.

Undefended Scenario

To get an understanding of the flood risk to properties in the scenario where the informal defences fail, a model was created with those defences removed. This model scenario was used to calculate the potential damages costs that the scheme will prevent.

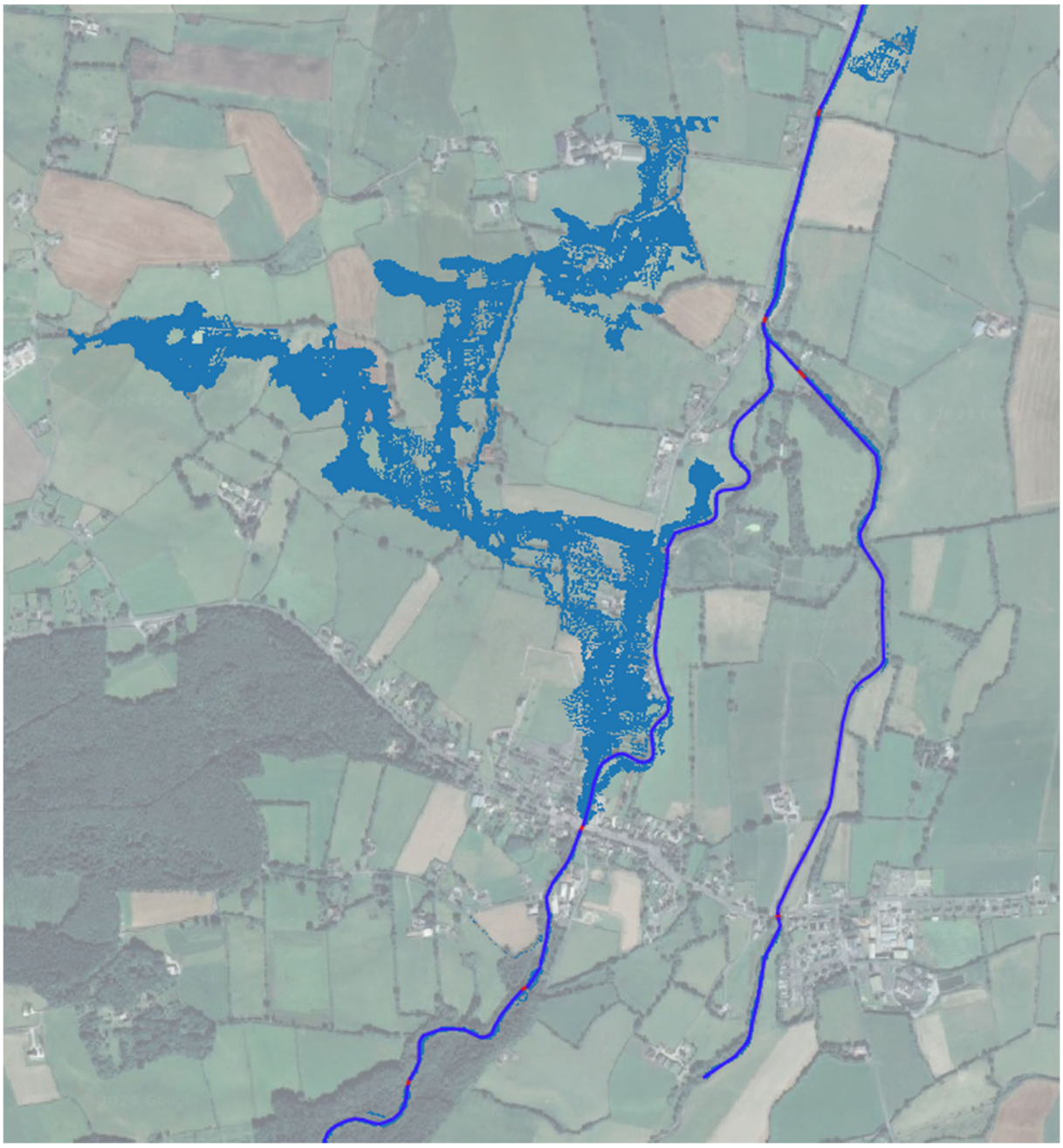

Figure 11-15 1% AEP event in the Undefended Scenario

Post-Scheme Scenario

The Clonaslee Flood Relief Scheme will upgrade the existing defences described above and ensure their integrity into the future. It will also install a debris trap in the Clodiagh River to prevent blockages at the bridge in Clonaslee. This is a flooding mechanism that was identified during Public Information Events.

Intuitively, the post-scheme flood model presents a very similar picture to the 'Do Nothing' Scenario.

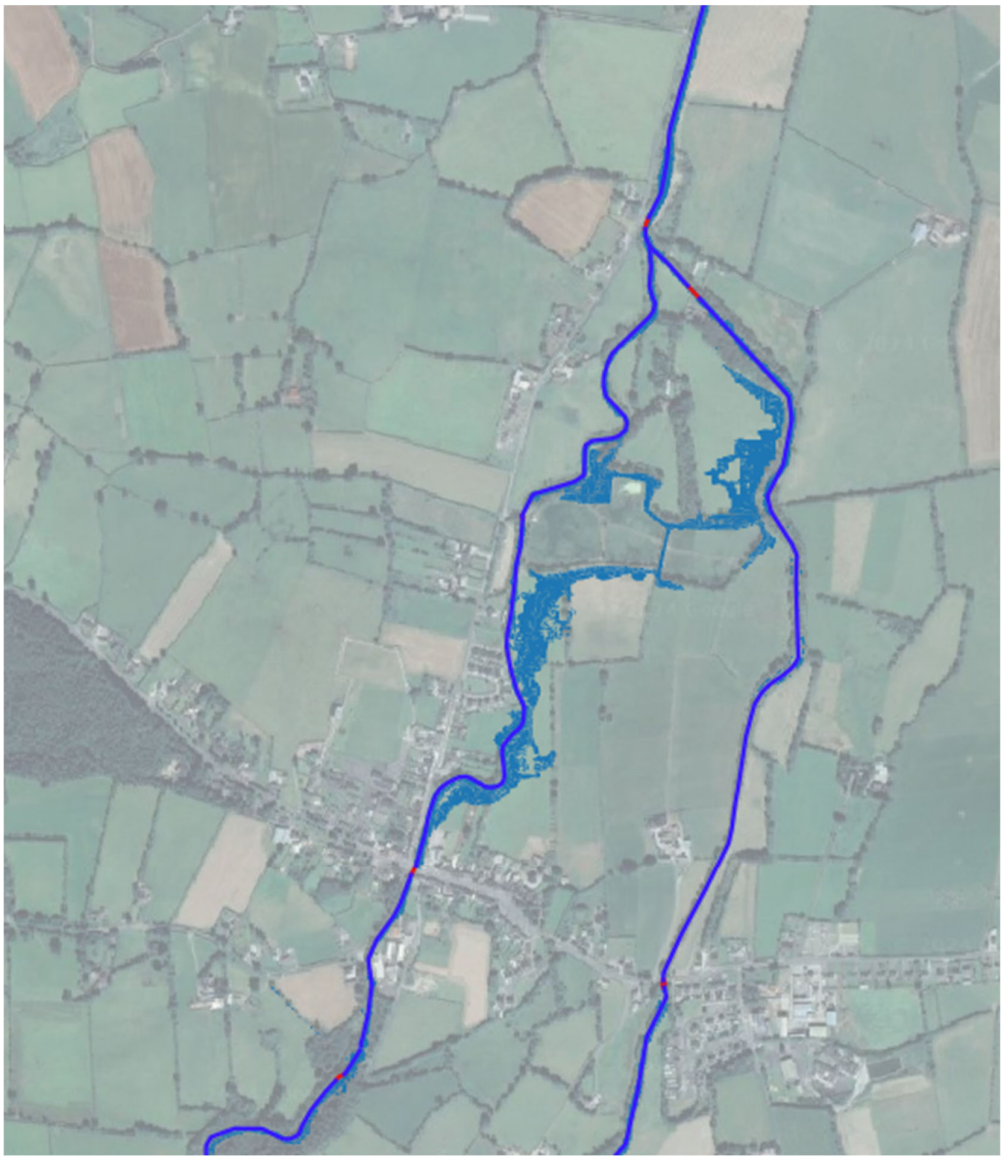

Figure 11-16 Post-Scheme 1% AEP Model Predicted flooding

Pre-Scheme CFRAMs Mapping

For completeness it is important to be aware of the currently publicly available flood mapping, generated during the CFRAM programme. As with the 'Undefended' scenario, the CFRAMs models did not include built structures and embankments that were not specifically designed and recorded as flood defences.

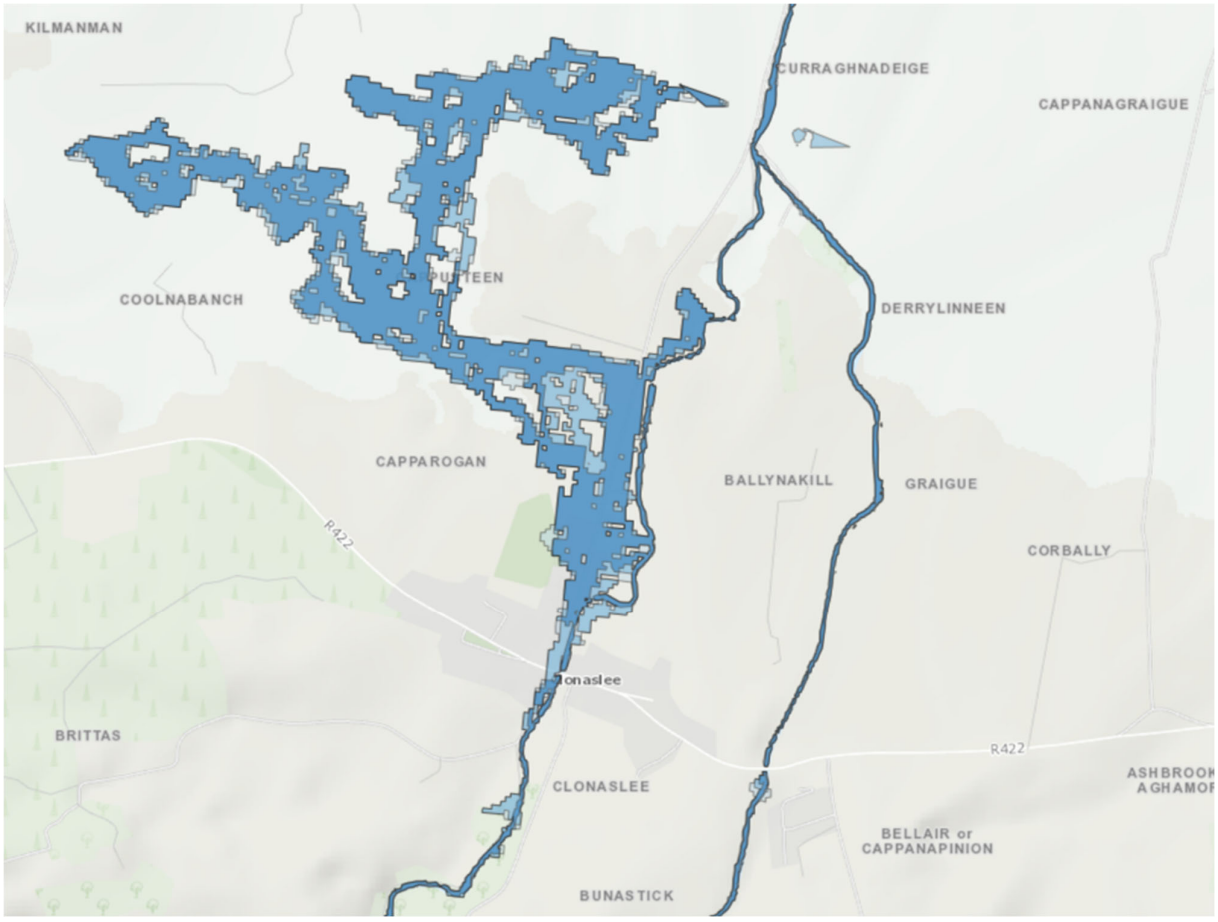

Figure 11-17 CFRAMS Mapping from www.floodinfo.ie

The total area at risk of flooding is deemed to be a composite of the flood plain in both scenarios where 1. when the informal defences remain intact and 2. when the informal defences are breached.

Approximately 72 residential and 2 commercial properties have been identified at flood risk. The main cause of flooding is the prolonged heavy rainfall in the steep upper Clodiagh River catchment area coupled with inadequate capacity of the river channels. Blockages in the river by woody debris accumulated at the existing bridge and at Clonaslee has also caused flooding in the past.

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

In the absence of the Proposed development, the current hydrological regime within the Study Area would not be expected to change significantly. The hydrological baseline may change due to Climatological parameters particularly global temperature rise could cause runoff variations and evapotranspiration. Additionally, the accumulation of greenhouse gases has a substantial impact on freshwater quality.

11.4 Description of Potential Impacts

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 **Chapter 18: Interactions & Cumulative Effects**.

11.4.1 Construction Phase

11.4.1.1 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 11.5** 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: Biodiversity**. Water quality impacts on compliance with WFD objectives is discussed in **Section 11.2.6**. Water quality impacts relating to groundwater are assessed in **Chapter 10: Land, Soil, Geology and Hydrogeology**.

11.4.1.1.1 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, protection of water quality and prevention of pollution has been a high priority in the design development and construction methods outlined in the Project Description. However, a short-term, reversible and **Small Adverse** impact can be expected in the absence of further mitigation and monitoring, causing a partial loss of a fishery or amenity.

11.4.1.1.2 Sensitivity of the Receptors

Owing to the Biotic Index of Q4-5 of the Clodiagh River, the receptor's sensitivity to water quality is considered to be **Very High**.

11.4.1.1.3 Significance of the Effect

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

11.4.1.2 Drinking Water

Construction activities could lead to increased runoff of contaminants and fuel spillages entering the Clodiagh and Gorragh river channels. These are protected drinking water rivers within the study area. The works in the vicinity of Brittas Wood could have an impact on the drinking water borehole sources. A number of boreholes are located in close proximity to the proposed flood protection embankment in Area 1 (as close as 6 m from the proposed embankment footprint). During the construction stage of the proposed flood protection embankment, groundwater quality could be impacted through polluted surface runoff entering/flowing from the construction site into these boreholes, if appropriate mitigation measures are not implemented. The project intends that these boreholes will be bunded around adequately to prevent any polluted surface runoff from flowing into these boreholes. Polluted surface runoff from the construction site will be collected and treated first before discharging back into the surface watercourses adopting appropriate mitigation measures as discussed Section 11.5.1. Further to this, a site-specific CEMP will be prepared by the contractor prior to the commencement of any works in order to ensure all works are carried out in a manner designed to avoid and minimise any adverse impacts on the receiving environment.

Short-term effects on groundwater quality can occur through the infiltration of surface runoff within or adjacent to construction areas. The impact is predicted to be localised to the Proposed Scheme. Refer to **Section 10.4.2.3** in **Chapter 10: Land, Soils, Geology and Hydrogeology** for further details on any potential impacts on groundwater sources during the construction stage of the scheme. Subsoil within the footprint of the proposed works is present at a sufficient depth to provide adequate attenuation and filtration, therefore, the infiltration of surface water runoff is considered to be an indirect, small adverse effect of moderate/slight significance on the groundwater environment.

11.4.1.2.1 Magnitude of Impact

In general, protection of the water abstraction boreholes has been a high priority in the design development and construction methods outlined in the Project Description. However, a short-term, reversible and **Small Adverse** impact can be expected in the absence of further mitigation and monitoring.

11.4.1.2.2 Sensitivity of Receptors

Owing to the potable water source to the town of Tullamore, the sensitivity of the receptor is considered to be **Very High.**

11.4.1.2.3 Significance of the Effect

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

11.4.1.3 Impact on Flood Risk

There is a possibility that a flood will occur on the River Clodiagh during the construction phase of the works. The existing Chapel St wall acts as a flood defence in low return period rainfall events. Measures will need to be put in place to ensure this wall does not become more vulnerable to breaching during construction. These will include some or all of the following measures as outlined in the Assessment of Alternatives and Project Description Chapters:

- Choosing a design that does not involve removing the existing wall or any section thereof;
- Phasing of the works to ensure a section of wall is not exposed for a prolonged period of time;
- Use of temporary flood defence measures in areas of works (e.g., sandbags, water dam structures or similar);
- Removal of existing flood defences (just if necessary) in discrete sections to minimise flood risk.

River flow management during construction of the debris trap will also be vulnerable to flood events. This risk will be managed by:

- Monitoring of weather events;
- Works will be scheduled in July – September which should correspond to low water levels;

- Management of flow through the works via gravity flow routes. Pumping should be avoided if practicable;
- Works should be planned and laid out to incorporate an overflow route through the works area should a flood event occur.
- All surface runoff from the construction compounds will be attenuated first before discharging into the surface watercourses.

11.4.1.3.1 Magnitude of Impact

Owing to the scheme design and construction methodology, it is considered that there will be no change in the predicted flood level or risk. The magnitude of impact is therefore assessed as being **Negligible.**

11.4.1.3.2 Sensitivity of Receptors

As the consequence of failure could result in more than 50 residential properties from flooding in the 1% AEP rainfall event, therefore the sensitivity is considered **Very High**.

11.4.1.3.3 Significance of the Effect

The magnitude of the impact is deemed to be Negligible and the sensitivity of the receptor is considered to be Very High. The effect will, therefore, in the absence of mitigation, be **Imperceptible**.

11.4.1.4 Impact on Hydromorphology

Instream works will be required to facilitate construction of the debris trap in Area 1 of the Proposed Scheme. Works will be undertaken during low level conditions as far as practicable and within the seasonal restrictions placed on the programme. The remaining works (the embankments and flooding walls) will be completed outside the River Clodiagh, limiting the need for instream works. Appropriate sediment control measures will be placed to avoid material entering the river.

A sediment control system will be provided in all works areas; including appropriate erosion and silt controls (e.g., settling ponds/tanks, silt fence, silt curtains) to prevent any flow of surface water from the site into the River Clodiagh and its tributaries. Refer to Section 11.5 for further details on this.

A site-specific CEMP will be prepared by the contractor prior to the commencement of any works in order to ensure all works are carried out in a manner designed to avoid and minimise any adverse impacts on the receiving environment. Further details regarding erosion and sediment control are provided in the Construction Environmental Management Plan (CEMP) and as mitigation in **Chapter 9: Biodiversity**.

The mitigation measures to control erosion during construction of the Proposed Scheme are detailed in **Chapter 10: Land, Soils, Geology and Hydrogeology**.

Impacts on hydromorphological conditions in relation to the ability of watercourses to support aquatic life is carried out in **Chapter 9: 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).

11.4.2 Operational Phase

11.4.2.1 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.

The debris trap is the only element of the scheme that will involve operation activities that could impact on the water quality. Collection of debris could promote sediment build-up, which when released could cause

temporary water quality degradation. Removing the accumulated debris on a regular basis will reduce this risk.

Overall, the long-term magnitude of impact on the water quality is considered to be **Negligible**. On a receptor of **Very High** sensitivity, the effect on water quality is considered to be **Imperceptible**.

11.4.2.2 Drinking Water

No negative impacts on drinking water are expected to occur in the operational phase of the proposed scheme. Drainage will be installed to ensure surface run-off is not directed towards water abstraction boreholes, and also to prevent ponding on the defended side of the embankment, where the boreholes are located.

The long-term effect of the scheme on Drinking Water is **Neutral**.

11.4.2.3 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 eliminate potential upstream and downstream effects.

11.4.2.3.1 Magnitude of Impact

There is no increase in flood risks to any lands and properties in the vicinity of scheme during the post construction stage of the scheme. Regular maintenance of the debris trap will however be required. Accumulation of debris has the potential to obstruct the river flow causing flooding in the upstream vicinity of the Debris Trap. The proposed embankment adjacent to the debris trap has been designed to cater for floodwater during a substantial blockage at the debris trap. An Operation and Maintenance Plan (OMP) will be prepared for the Proposed Scheme for removing the debris (See **Table 11-15**).

The proposed wall and embankment defences will protect the village in the 1% AEP fluvial flooding event. Of the 72 residential and 2 commercial premises considered at risk of flooding, none will remain at risk once the scheme is complete.

Overall, the magnitude of impact on the flood risks during the operation stage of the proposed scheme is expected to be **Major Beneficial** for a receptor sensitivity rating of **Very High**. The effect will, therefore, be of **Profound positive significance**.

11.4.2.4 Impact on Hydromorphology

The potential for scour and erosion may increase due to increased flow velocities and flow patterns at riverbanks and in-stream structures such as Debris Traps particularly during flood conditions. The hydraulic model results have been analysed to quantify potential changes to the pre- and post-development maximum water velocities at discrete cross sections along each affected watercourses during the 50% AEP and 1% AEP fluvial flood events to estimate the impact of the Proposed Scheme on scour and erosion potential. **Table 11-14** below presents the changes in flow velocities in the upstream and downstream vicinity of the proposed flood relief measures.

Table 11-13 Changes in flow velocities during the 50% AEP and 1% AEP Flood events

Areas	Maximum changes in flow velocity over the baseline condition (%)			
	50% AEP Event		1% AEP Event	
	U/S	D/S	U/S	D/S
Area 1: Brittas Wood (immediately local to the Debris Trap)	-15.4% (CLOD05673)	+45.9% (immediate d/s)	-19% (CLOD05673)	+0.16% (CLOD05614!)
Area 2: Chapel Street	+0.09% (CLOD05439)	+1.9% (CLOD4964)	+0.5% (CLOD05392)	+4.34% (CLOD05011)
Area 3: Tullamore Road	0% (CLOD04544I)	0% (25CLOD02855)	-0.07% (CLOD04544I)	-0.08% (25CLOD02855)

It can be seen from **Table 11-14**, in Area 1 flow velocity would decrease upstream of the Debris Trap and increase downstream, both during the 50%AEP and 1%AEP flood events. The cause of this decrease in flow velocity can be attributed to the increase in flow depth as a result of the construction of Debris Trap. It is not expected that this decrease in flow velocity would cause any significant siltation in the upstream vicinity, since the flow velocity in both cases (events) are in excess of non-silting velocity of 0.75 m/s. During the 50% AEP flood event, some scouring at the riverbed immediately downstream of the Debris trap could occur as a result of the significant increase in flow velocity. The proposed concrete foundation under the Debris Trap limits the amount of scour that is possible. The concrete base itself will be given a roughened finish to promote the capture of sediment and promote the filling of scour holes after high flow events. It will be set 500m below the natural bed level.

In Area 2, the Hydraulic model simulations show a slight increase in flow velocity, in the immediate upstream and downstream vicinity of the proposed flood relief measure (maximum increase 4.34%), both during the 50% AEP and 1% AEP flood events. It is not expected that, this slight increase in flow velocity would cause any scouring to the riverbed and banks.

In Area 3, no changes in flow velocity are expected, and hence any predicted effect on scour and erosion potential would be imperceptible.

With the incorporation of design measures and adopting an appropriate Operation & Maintenance Plan, overall, the predicted long term hydromorphological effects are expected to be **slight** to **moderate**.

Further details on any potential effects on the river channels hydromorphology and fisheries environment as a result of the proposed scheme construction are provided in **Chapter 9: Biodiversity**.

11.4.2.5 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 Clodiagh River as it is potentially affected by the Proposed Scheme. 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).

Refer to **Appendix 11-1 Water Framework Directive Compliance Report** and **Chapter 9: Biodiversity** for further details on the above-mentioned WFD related assessments relevant to this Flood Relief Scheme.

11.5 Mitigation Measures

11.5.1 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 CIEEM

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;
- 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 wall construction by:

- Edge protection along the riverfront or a floating boom cordoning off an area of the river below the works to be implemented to prevent debris entering the river.

Flood preparedness:

- Checking water levels at Bracknagh Bridge gauge on a daily basis or twice daily during times of high flow when works are occurring in the vicinity of the River Clodiagh;
- Developing an emergency response and evacuation procedure for all works areas including removal of potential contaminants and construction plant.

Miscellaneous:

- Following consultation with IFI, instream works are restricted to appropriate seasonal windows (1st July to 30th September);
- Instream works areas to be left clean of all residual construction waste and potential pollutants before re-flooding;
- Backup pumps and generators to be in place where over-pumping is taking place to mitigate flood risk;
- Foul water is to be stored and tankered away for treatment as needed;
- 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;
- 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;
- 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: Biodiversity (Section ref. 9.6)** and also in **Chapter 10: Land, Soils, Geology and Hydrogeology**. Also refer to **Section 5.5** in **Chapter 5: Project Description** where a detailed construction methodology for various elements of the flood relief measures is provided. The construction sequencing recommended in this section will minimise any impacts on water environment during the construction stage of the works.

11.5.2 Operation and Maintenance Phase

Operational and maintenance of the Proposed Scheme will not require any additional dedicated employees. It is expected that the operation and maintenance activities required will be undertaken by existing Laois County Council maintenance personnel.

An Operation and Maintenance Plan (OMP) will be prepared for the Proposed Scheme and will include an inspection and maintenance regime/procedure of all flood defence infrastructure. Maintenance activities may include structural repairs, debris removals from Debris Trap, culvert inspection and jetting, vegetation management and channel maintenance. **Table 11-15** provides a description of the expected maintenance activities required for the Proposed Scheme.

Table 11-14 Operational and Maintenance Activities Table

Element	Activity	Frequency
Flood walls	Inspections	Annually
	Repairs	As req

Element	Activity	Frequency
	Vegetation control	Annually
Debris Trap	Inspections	Monthly
	Repairs	As req
	Removal of debris	As req
Culverts	Inspections	Annually
	Repairs	As required
	Removal of trash and vegetation	Quarterly
Embankments	Inspections and maintenance	Annually
	Vegetation control	Annually
	Vermin control	Bi-annually
	Back drainage improvements	Bi-annually

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 minimal further construction activity in raising embankments. Environmental assessments will be completed before such activity is carried out.

Further information on operational phase mitigation measures in relation to the aquatic environment can be found in Section 9.6 of **Biodiversity Chapter** (**Chapter 9**).

11.6 Residual Impacts

11.6.1 Water Quality

During the operational and construction stages the project drainage design, mitigation measures and infrastructure will limit the risk to watercourses and the hydrological environment from flooding and runoff contamination. Post-implementation of mitigation measures, the magnitude of impact is reduced to Small Adverse. On a receptor of Very High sensitivity, the residual impact is considered to be **Significant/Moderate and temporary** during construction.

Residual impacts on ecological receptors are discussed in **Chapter 9: Biodiversity** (**Section 9.7**).

11.6.2 Flood Risk

During operation the scheme will deliver significant benefits. With the flood risk management mitigation measures and operational procedures in place during the construction, it is expected the impact on flood risk to remain as **Imperceptible**.

11.6.3 Drinking Water resources

Runoff prevention mitigation measures and water quality monitoring will reduce the Magnitude of Impact from Moderate Adverse to **Negligible**. This reduces the predicted effect on Drinking Water resources to **Imperceptible**.

11.6.4 Hydromorphology

No residual impacts on scour and erosion are anticipated. Any scouring at the Debris trap will be monitored on a regular basis. With all mitigation measures in place any residual effects on the Scour are expected to be **Imperceptible**.

11.7 Monitoring

11.7.1 Construction Phase

A risk-based approach will be used when determining what and where to monitor, based on the construction activities. For the Clonaslee FRS, it is recommended that water quality monitoring for River Clodiagh should be undertaken, both upstream and downstream of the scheme area, during the construction of the project. The frequency of monitoring shall be determined by the Ecological Clerk of Works (EcOW) and shall be appropriate to the conditions at time of construction and will reflect the risk of the various activities (e.g., instream works, concrete pouring, excavation, headwall installation).

The following water quality monitoring activities should be undertaken the construction phase:

- Water quality checks (up to twice daily during wet weather conditions) at watercourses downstream of active works sites including:
  - A visual check of turbidity levels and measurements using a calibrated hand-held probe.
  - Measuring pH using a calibrated hand-held probe.
  - A visual check for evidence of oil slicks.
  - Note to be made of any foul odours.
- Monitoring of dewatering effluent to ensure adequate treatment before release to environment.
- Daily inspections of all silt fencing and other silt control measures for integrity and efficacy.
- Monitoring the condition of roads around the compound and works sites and order washing where build-up of mud becomes visible.
- Checking weather forecasts to ensure suitable programming of earthworks activities and instream works.

Refer to **Section 10.7.1.4** in **Chapter 10: Land, Soils, Geology & Hydrogeology** for the recommended groundwater quality and level monitoring plan during the construction stage of the works. Section 9.8.3 of the Biodiversity Chapter (Chapter 9) also provides a detail plan for monitoring of surface water quality during the construction stage of the proposed works.

11.7.2 Operation and Maintenance Phase

It is expected that the OPW will continue to monitor flows in the River Clodiagh at Bracknagh Bridge gauging station. 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 OMP 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 OMP. Repairs and remediation works will be carried out on permanent scheme elements as needed.

11.8 Interactions and Cumulative Effects

11.8.1 Interactions

Please see **Chapter 18: Interactions and Cumulative Effects** for details.

11.8.2 Cumulative Effects

Please see **Chapter 18: Interactions and Cumulative Effects** for details

11.9 Conclusion

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

- Surface Water Quality (WQ);
- Drinking Water Resources (DWR);
- Flood Risk (FR); and
- Fluvial Geomorphology (FG).

An overview of potential impacts considered in relation to the above parameters along with the mitigation and monitoring commitments recommended in this chapter is contained in **Table 11-17.**

Table 11-15 Summary of impacts, mitigation measures and residual effects

Description of Impact	Magnitude of Impact	Importance of Receptor	Significance of Effect	Controls, Monitoring and Mitigation Measures	Residual Effect
Flood Risks	Negligible	Very High	Imperceptible/Profound Positive post-scheme	Mitigation measures set out in Chapter 11: Water – section 11.5	With the incorporation of mitigation measures, the residual effect Imperceptible/profound positive.
Drinking Water Sources	Negligible	Very High	Profound Significant	Mitigation measures set out in Chapter 11: Water – section 11.5	With the incorporation of mitigation measures, the residual effects on drinking water resources are anticipated to be Imperceptible
Water Quality Risk	Negligible	Very High International/National importance	Profound/Significant	Water pollution control measures set out in Chapter Section 11.5 and Chapter 9: Biodiversity.	With the incorporation of mitigation measures, the residual effect is Significant/Moderate and temporary during construction.
Hydromorphology	Small Adverse	High	Slight to Moderate		With the incorporation of mitigation measures, and adopting an appropriate Operation & Maintenance Plan, the residual effect is reduced to Imperceptible.

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