Appendix 10

Appendix 10.1

Water Status Impact Assessment

WATER STATUS IMPACT ASSESSMENT (WSIA)
BURNFOOT FLOOD RELIEF SCHEME

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1 INTRODUCTION

1.1 Background

The completion of a Water Status Impact Assessment (WSIA) is a staged process where data on the study area and work proposals are assessed with respect to the requirements of the WFD to ascertain if the proposals will or will not have a detrimental impact on the status of water bodies that have the potential to be impacted by the proposed works. If the assessment concludes, after taking account of the mitigation proposed, that the proposal may either result in a deterioration of the status of the water bodies or prevent them from reaching their environmental objectives, then this represents a failure to achieve the WFD objectives and it should not go ahead unless justification for the works is demonstrated under Article 4.7 in the context of new modification or Article 4.3 in the context of existing specified uses and Heavily Modified Water Bodies.

The proposed flood relief scheme (FRS) for which this WSIA has been completed is located in County Donegal within the village of Burnfoot which lies to the east of the confluence of two small catchments, the Burnfoot River and the Skeoge River (**Figure 1.1**). The Burnfoot River drains a narrow valley from the east, flowing under the R238 through the village and meets the Skeoge River before they both drain out into Lough Silly via a tidal lagoon behind Inch Island. The Skeoge River drains an area including the outskirts of Derry City and flows past the south west of Burfoot village before it meets the Burnfoot River. The Burnfoot River is subject to flash flooding with the village at risk of fluvial flooding. There is also a large area of flat, reclaimed agricultural land downstream of the village which is subject to both coastal and fluvial flooding. Following hydrological and hydraulic analysis undertaken as part of the Proposed Scheme, it has been established that the main source of flood risk to Burnfoot originates from fluvial driven water levels in the Burnfoot River. The scheme includes the construction of earthen embankments, the demolition and reconstruction of an existing road bridge, the removal of arterial drainage embankments to facilitate floodplain reconnection, upgrades to existing and construction of new culverts and surface water drainage works.

The watercourses along which the scheme is proposed are the Burnfoot River and Carnashanagh Stream within the Burnfoot_020 river water body and the Burnfoot River and Skeoge River within the Skeoge_010 river water body both of which flows in a westerly direction before discharging into Inch Lough,. Inch Lough is directly connected to Swilly Estuary and both are within the boundaries of Lough Swilly SAC and SPA.

Whilst Environmental Assessment is an efficient mechanism to gather the relevant information for WFD compliance assessment, it still needs to be interpreted in relation to the WFD objectives. According to the draft Planning System and RBMP Management Guidelines for Planning Authorities (the RBMP Guidelines) and other competent authorities guidance such as the Environment Agency, impacts of biology, chemistry and hydromorphology need to be considered in relation to WFD status classes and reported under a specific WFD section in any environmental statement or report produced or in a separate WFD compliance report (Environmental Agency, 2010). Therefore, a Water Status Impact Assessment (WSIA) has been undertaken to demonstrate the potential impact caused by the different activities associated with the Burnfoot FRS in the context of the environmental objectives of any affected WFD surface water bodies. The WSIA also offers the opportunity to inform the management of the flood relief measures to avoid, minimise, mitigate or compensate for the risks to the environmental objectives of WFD surface water receptors where the risk assessment determines that the activities have the potential to:

I. Cause a surface water body to deteriorate from one WFD status class to another or cause significant localised impacts that could contribute to this happening; and

II. Prevent or undermine action to get surface water bodies to good status (e.g. compromise the programme of measures put in place to achieve the ultimate water body objective).

1.2 Information Sources

The information used in the preparation of this appendix is set out in Table 1.1: Information sources.

Table 1.1 Information Sources

Source	Data	Information consulted/provided
WFD	WFD data tables https://wfd.edenireland.ie/data	*Water body status, objectives, hydro-morphology, protected areas, sensitive habitats*
	Water body data pages on Eden WFD application https://wfd.edenireland.ie/	*Water body classification, overall status, ecological status, biological elements, physico-chemical elements, hydro-morphology and chemical classification*
		WFD objectives for water bodies
EPA	Interactive maps https://gis.epa.ie/EDENMaps/WFD	*Maps of water bodies, habitats and protected areas.*
Inland Fisheries Ireland (IFI)	WFD Fish Monitoring Programme	Summary report of the WFD fish status monitoring undertaken in the Burnfoot catchment as part of the WFD monitoring programme
Donegal County Council	Baseline studies undertaken as part of the FRS scheme development and assessment	Aquatic ecology surveys, River Hydromorphological Assessment Technique (RHAT) surveys, water quality, invasive species surveys, Natura Impact Statement (NIS)

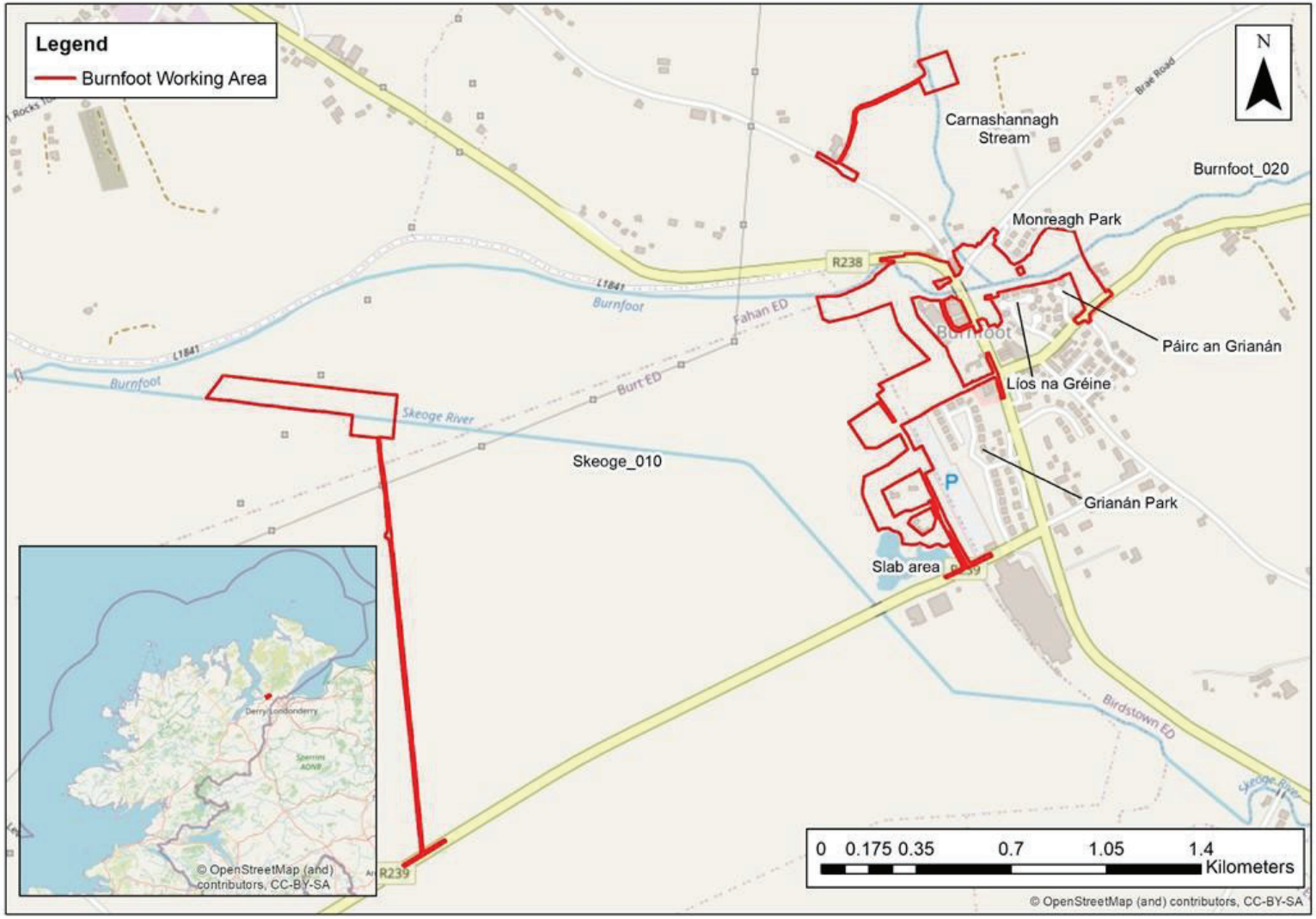

Figure 1.1 Site Location

2 LEGISLATION AND GUIDANCE

2.1 Water Framework Directive

The WFD (Council Directive 2000/60/EC establishing a framework for community action in the field of water policy) was adopted by the European Commission in December 2000. The WFD requires that all European Union Member States prevent deterioration and protect, enhance and restore all bodies of water. This means that Member States must ensure that new schemes do not adversely impact upon the status of aquatic ecosystems, and that they must address historical modifications that are already impacting a water body. To try to restore the water body to good ecological status would mean that the specified use would be significantly impacted and as there are no alternative options these water bodies are proposed HMWBs. The objective in these instances is to achieve Good Ecological Potential. A heavily modified waterbody is considered to be at GEP when it has

- the relevant mitigation measures in place;
- achieved Good (or better) condition for the monitored biological quality elements (BQE) that are not sensitive to the hydromorphological modification;
- achieved the physico-chemical conditions equivalent to Good Ecological Status, except where parameters are impacted by the hydromorphological alteration caused by the specified use; and
- achieved the best state previously achieved since the modification for the monitored biological quality elements that are sensitive to the hydromorphological modification, where those data are available.

The WFD was transposed into Irish law through the European Communities (Water Policy) Regulations 2003 (S.I. 733/2003) in respect of the duties on all public authorities to exercise their functions in a manner consistent with achieving the objectives of the WFD. European Communities Environmental Objectives (Surface Waters) Regulations 2009 (S.I. 272/2009) and the European Communities Environmental Objectives (Groundwater) Regulations 2010 (S.I. 9/2010) give further effect to the WFD in Ireland. Article 5 of both these regulations provide that public authorities must not undertake their functions in a manner that knowingly causes or allows deterioration in the status of water body.

The WFD is given general effect in planning legislation in Section 1A of the Planning and Development Act 2000 (S.I. 30/2000), as amended; and specifically through amendments made in 2010 which sought to improve how water management and the planning system are integrated.

2.2 Compliance with the Water Framework Directive

Planning Authorities must consider whether proposals for plans or new developments have the potential to prevent compliance with the WFD objectives i.e. will they cause a deterioration of the status of a water body and / or prevent future attainment of good surface water status or good ecological potential and good groundwater status where not already achieved. To facilitate this, a new process is being implemented and is termed a Strategic Water Status Impact Assessment (SWSIA) for plans and a Water Status Impact Assessment (WSIA) for new development proposals. This is a separate, standalone assessment process but it includes clear opportunities to inform and be informed by other established environmental assessment processes, including but not limited to Strategic Environmental Assessment (SEA), Appropriate Assessment (AA), Environmental Impact Assessment (EIA) and Flood Risk Assessment (FRA) which may be ongoing in parallel.

For the avoidance of doubt, all statutory land use plans must undertake a SWSIA. Statutory land use plans are those included in the Planning and Development Act 2000, as amended and include: National Planning Frameworks; Regional Spatial and Economic Strategies; City and County Development Plans; Local Area Plans; and Planning Schemes for Strategic Development Zones (SDZ).

In the case of non-statutory plans (masterplans, action area plans, site briefs) SWSIA is also required, where: the plans come under the statutory plan process e.g. a masterplan being incorporated into a Development Plan or as Variation; or where a masterplan, action area plan or site brief is required for a planning application as part of the development management process.

Furthermore, all development proposals will need, as a minimum, to be screened for WSIA. Development proposals within, or that could affect the water environment must demonstrate that they will not cause a deterioration of the status of water bodies in their zone of influence, or that they will not inhibit their future achievement of "good" status. In some situations, it will be clear that a development proposal would not compromise the achievement of the WFD objectives and therefore no further assessment will be required. However in other situations, the potential to compromise the achievement of the objectives may be identified or there may be uncertainty and the development proposal will need to undergo WSIA and a WSIA Report will have to be prepared to inform decision making by the planning authority.

2.3 Steps in the Water Status Impact Assessment Process

The RBMP guidelines state that WSIA is undertaken in three stages:

- **Stage 1 WSIA Screening** – excludes any activities that do not need to go through the scoping or impact assessment stages.
- **Stage 2 WSIA Scoping** – to identify potential risks associated with a development proposal on the relevant water bodies and their water quality elements.
- **Stage 3 WSIA impact assessment** – to undertake a detailed assessment of water bodies, their quality elements and activities carried forward from the scoping stage.
- **Stage 4 – Justification or Exemption** - rigorous assessment of the appropriateness, or otherwise, of particular developments that, for various reasons, are being considered despite failure to comply with the objectives of the WFD, as laid down in Article 4(7).

The key steps in the development stage WSIA process are briefly outlined in **Table 2.1**

Table 2.1: Key Steps in the Water Status Impact Assessment Process

WFD Assessment Steps	Development Management
Screening	WSIA screening is required to determine whether a development proposal would screen in / out for more detailed consideration of WFD objectives.
Scoping & Consultation	Once a development proposal is screened in for WSIA it will rely on the professional expertise of the applicant's specialist consultants8 and, if/as required, the Environment Section of the planning authority and other bodies to engage in more specific pre-application consultation in relation to WSIA requirements and to agree the scope of WSIA. The scope of the WSIA must be proportionate to the type and scale of development and the sensitivity of the water body(s).
Assessment & Reporting	Applications for development proposals which have screened in for detailed consideration of WFD / RBMP objectives, must be accompanied by a WSIA Report and (where screened in for EIA also) an EIAR, which clearly demonstrates that the proposal is compliant with the objectives of the WFD i.e., it will not cause or contribute to deterioration of status or jeopardise the water body achieving good status. Where the competent authority concludes that significant negative impacts on a water body cannot be fully avoided (i.e. with the potential to cause deterioration of its status or jeopardise its attaining good status), or uncertainty remains of the extent of impact, it is required to refuse consent, unless a derogation under article 4 (7) is sought and justified under the strict conditions of the WFD for new modifications. In the case of existing operations that are potentially compromising the WFD environmental objectives the water body may be determined to be Heavily Modified under Article 4 (3). Where water quality is an issue (but not so as to cause the deterioration of the status of any body of water or jeopardise its attaining good status), the competent authority shall consider granting permission subject to conditions to deal with any residual risk and must be guided by the development management objectives set out in the development plan.
Mitigation and Monitoring	Where potential for significant effects is identified, a mitigation and monitoring strategy shall be presented. This can align with EIAR requirements if screened in for EIA. Otherwise a mitigation and monitoring strategy should be agreed with the planning authority and the developer to ensure no unforeseen effects from the construction or operation of the development.
Justification or **WFD Exception**	Where a development proposal is considered likely to cause deterioration of the status (or potential) of a surface or groundwater body or prevents the achievement of good groundwater status, good ecological status / potential for water bodies currently failing to achieve this status / potential, Article 4(7) of the WFD provides a derogation whereby a Member State will not be in breach of the Directive provided all the conditions set out in Article 4(7) are met.

2.3.1 Stage 1 – WSIA Screening

Where a development requires mandatory EIA, or it is screened in for EIA if it is not mandatory, Water is a prescribed environmental factor to be addressed in the EIAR. The development would therefore automatically screen in for WSIA and a WSIA Report must be prepared by a suitably qualified professional and submitted with the application.

In some situations, it will be clear that a proposed development could not cause deterioration or compromise the achievement of good status / potential and it should screen out for WSIA. For example, where the nature, scale, timing, duration and location of a development is entirely unconnected to a water body or will not contribute to a further deterioration of the water body's current status. These instances will generally be small developments, for example signage or changes of use or extensions to existing buildings in serviced urban areas.

Other development proposals may require further consideration for WSIA screening. In these situations, the source-pathway- receptor (S-P-R) model will be useful in terms of considering the potential risk of a proposed development causing further deterioration of the water body's current status, for example, if the proposed development includes a source (e.g., risk of pollution), is there a pathway (i.e., hydrological connectivity [including flood risk] via water body or groundwater) and is there a receptor (i.e., water body at risk). Figure 2.1 outlines the screening process.

2.3.2 Stage 2 – WSIA Scoping

Scoping considers how a development proposal could affect the different WFD quality elements. Each aspect or activity associated with the development with the potential to impact the achievement of the WFD should be considered and then summarised in table form for each water body.
WFD Scoping should involve:

- Undertaking an initial assessment to identify the risks from the development proposal to receptors (within the zone of influence) based on the relevant water bodies and their water quality elements; and
- Identification of those water bodies where a more detailed impact assessment is required.

This will require that the types of impact be identified, e.g., on what quality element; whether the effects are short, medium or long-term and, construction, operational or decommissioning related.

2.3.3 Stage 3 – WSIA Assessment

The Stage 3 assessment process is focused on assessing the potential for the proposed development to impact on the objectives of the WFD and the RBMP. This can be an iterative process and the objective should be to find an appropriate solution wherever possible – this may include assessment and amending the design and/or including measures to mitigate the particular elements of the development that posed the risk.
The particular elements of the proposed project that have the potential to adversely affect the quality of a water body must be examined with respect to the specific objectives of the WFD and the RBMP. The information collected should facilitate:

1. The identification and description of those aspects of the project that may affect a water body;
2. A description of the characteristics of relevant water body, including their WFD objectives and an understanding of factors which either maintain or threaten those objectives;
3. An assessment of the impact of the proposed development on the relevant objectives; and
4. To conclude whether the proposed development will:
    a. Cause or contribute to deterioration of status; or
    b. Jeopardise the water body achieving *good status*

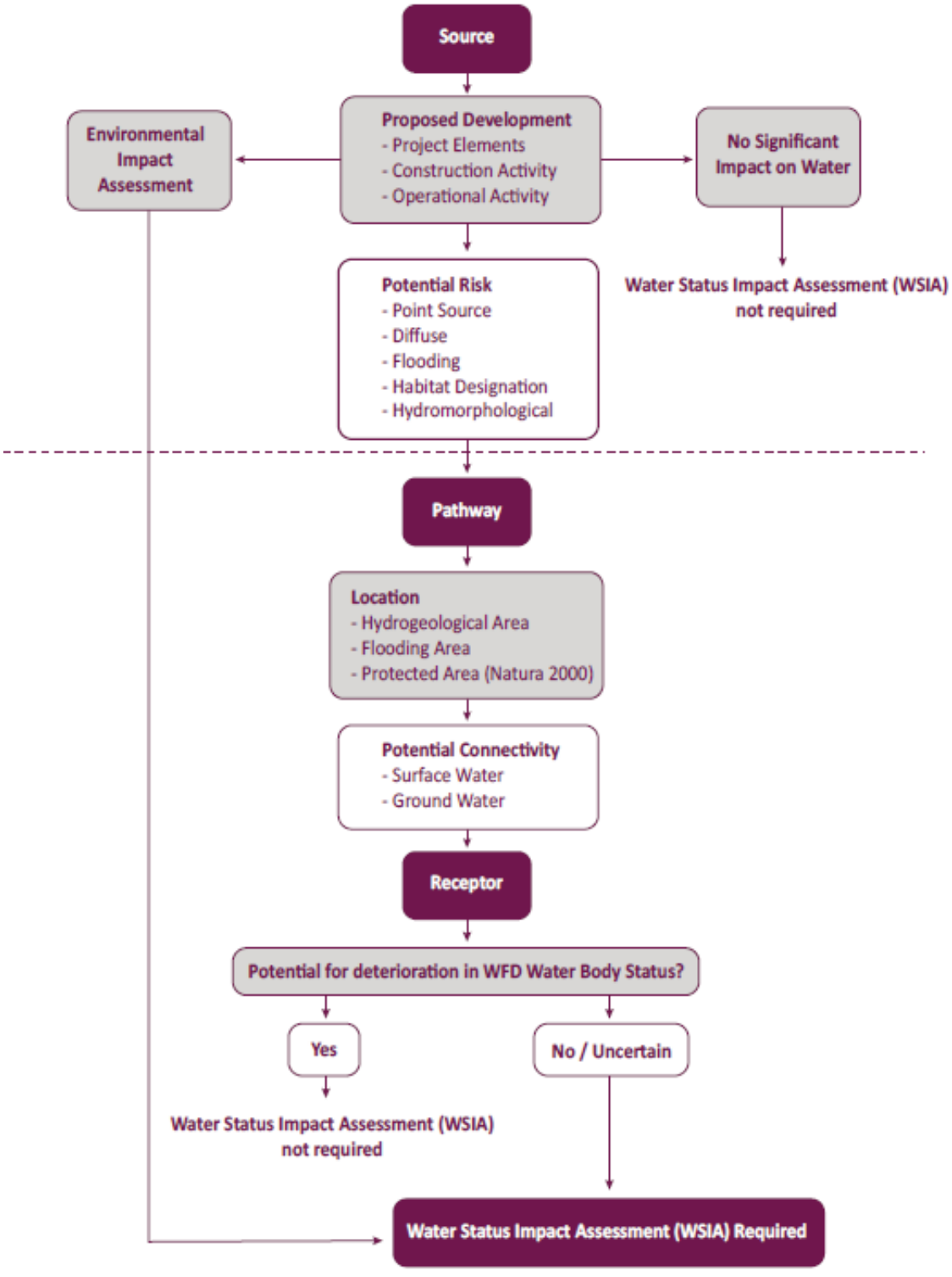

Figure 2.1 Screening Process

2.4 Water Body Classification

The WFD specifies the quality elements that are used to assess the ecological and chemical status of a water body. Quality elements are generally biological (e.g. fish, invertebrates, macrophytes) or chemical (e.g. heavy metals, pesticides, nutrients). Classifications indicate where the quality of the environment is good, where it may need improvement, and what may need to be improved. They can also be used, over the years, to plan

improvements, show trends and to monitor the effectiveness of the programme of measures identified. There are two status classifications which are commonly reported, ecological and chemical.

Chemical status is assessed from compliance with environmental standards for chemicals that are priority substances and/or priority hazardous substances. These are known as 'Annex X' substances as they were originally listed in Annex X of the Water Framework Directive, which has now been superseded by the Environmental Quality Standards Directive (2008/105/EC). Chemical status is recorded as 'good' or 'fail'. Chemical status for a water body is determined by the worst scoring chemical (one-out-all-out approach).

Ecological status classifications can be composed of up to four different assessments:

- An assessment of status indicated by a biological quality element such as fish, invertebrates or algae. The presence of invasive species is also assessed as a separate test;
- An assessment of compliance with environmental standards for supporting physico-chemical conditions, such as dissolved oxygen, phosphorus or ammonia;
- An assessment of compliance with environmental standards for concentrations of specific pollutants, such as zinc, cypermethrin or arsenic (these are known as 'Annex VIII' substances); and
- In determining high status only: A series of tests to make sure that hydromorphology is largely undisturbed.

Ecological status is recorded as high, good, moderate, poor or bad. 'High' represents 'largely undisturbed conditions'. Other classes show increasing deviation from undisturbed or reference conditions. This deviation must be expressed as an ecological quality ratio (EQR) which ranges from zero for bad status to one for high status. As with chemical status, ecological status is determined by the worst scoring component (one-out-all-out approach).

Biological status is a sub-set of ecological status where the results of the biological quality elements are assessed (and so ignore physico-chemical and Annex VIII substances and hydromorphology). The one-out-all-out rule is applied again here to give a biological status classification.

Overall status is a composite measure that looks at both ecological status and chemical status. So, it considers all four assessment types under ecological status (biology, physico-chemical, Annex VIII substances and hydromorphology) as well as incorporating the results of the chemical status assessment (priority substances). The one-out-all-out rule is applied again here, so a water body must be good or better ecological status, and good (pass) chemical status assessment to be given a good overall status.

2.5 Water Body Objectives

The completion of a WFD assessment is a staged process where data on the study area and work proposals are assessed with respect to the requirements of the WFD to ascertain if the proposals will or will not have a detrimental impact on the status of water bodies associated with that site. If the assessment concludes, after taking account of the mitigation proposed, that the proposal may either reduce the quality status of the water bodies or prevent them from reaching the required status, then this represents a failure to achieve the WFD objectives and it should not go ahead unless justification for the new modification is demonstrated under Article 4.7 of the Directive. The four objectives of the WFD Assessment are:

1. Objective 1: To prevent deterioration in the ecological status of the water body;
2. Objective 2: To prevent the introduction of impediment to the attainment of Good WFD status for the water body;
3. Objective 3: To ensure the attainment of the WFD objectives for the water body are not compromised; and
4. Objective 4: To ensure the achievement of WFD objectives in other water bodies within the same catchment are not permanently excluded or compromised.

3 BASELINE ENVIRONMENT

3.1 WFD Status Classification

The flood relief scheme area is located within the village of Burnfoot, County Donegal in the Lough Swilly catchment. The works are to be completed along the waterbodies of the Skeoge and Burnfoot Rivers (Figure 3.1) which discharge into Inch Lough to the West. The waterbodies are fed by an abundance of smaller tributaries.

The Skeoge headwaters flow through Derry/Londonderry under roads including the A2 and A515. This cross border river flows between Lough Swilly and the River Foyle. The channels are Rivers Agency designated through the city with many culverts under the urban areas, so much so that the section of the Skeoge_010 river water body within Northern Ireland (46% of the total length of the channel with this water body) has been designated as Heavily Modified due to Urban pressures and therefore the objective for the water body within Northern Ireland is “good ecological potential”. There are small streams flowing down Greenan Mountain to the south west and from the hills in the north east. The Burnfoot River (Burnfoot_020) meanders along a tight valley with mountains to the north. The rivers flow through a mixture of urban, pastures and arable land. The confluence of the Burnfoot River and Skeogh River is immediately upstream of Lough Swilly (NIEA, 2015).

Table 3.1: Breakdown of the contributing elements to the status classification of the river bodies affected by the proposed flood relief scheme in for the WFD monitoring period 2019-2024.

Water body affected (WFD Code)	Overall Status	Ecological status	Chemical status	HMWB	Driving element for status classification	WFD Objective for 2027
Burnfoot_010 IE_NW_39B020200	Poor	Poor	-	Unknown	*Biological - Benthic inverts*	Good
Burnfoot_020 IE_NW_39B020600	Poor	Poor	Failing to achieve good	Unknown	*Biological – Fish & Benthic inverts*	Good
Skeoge_010 UKGBNINW393901002	Poor	Poor	-	Unknown	*Biological – Benthic inverts*	Good
Inch Lough IE_NW_220_0300	Moderate	Moderate	-	No	*Biological – Benthic inverts*	Good

The significant pressures preventing the water bodies from reaching good status are pollution from wastewater, physical modifications and pollution from towns and transport. The key sectors identified as contributing to these issues are water industry and local and central government.

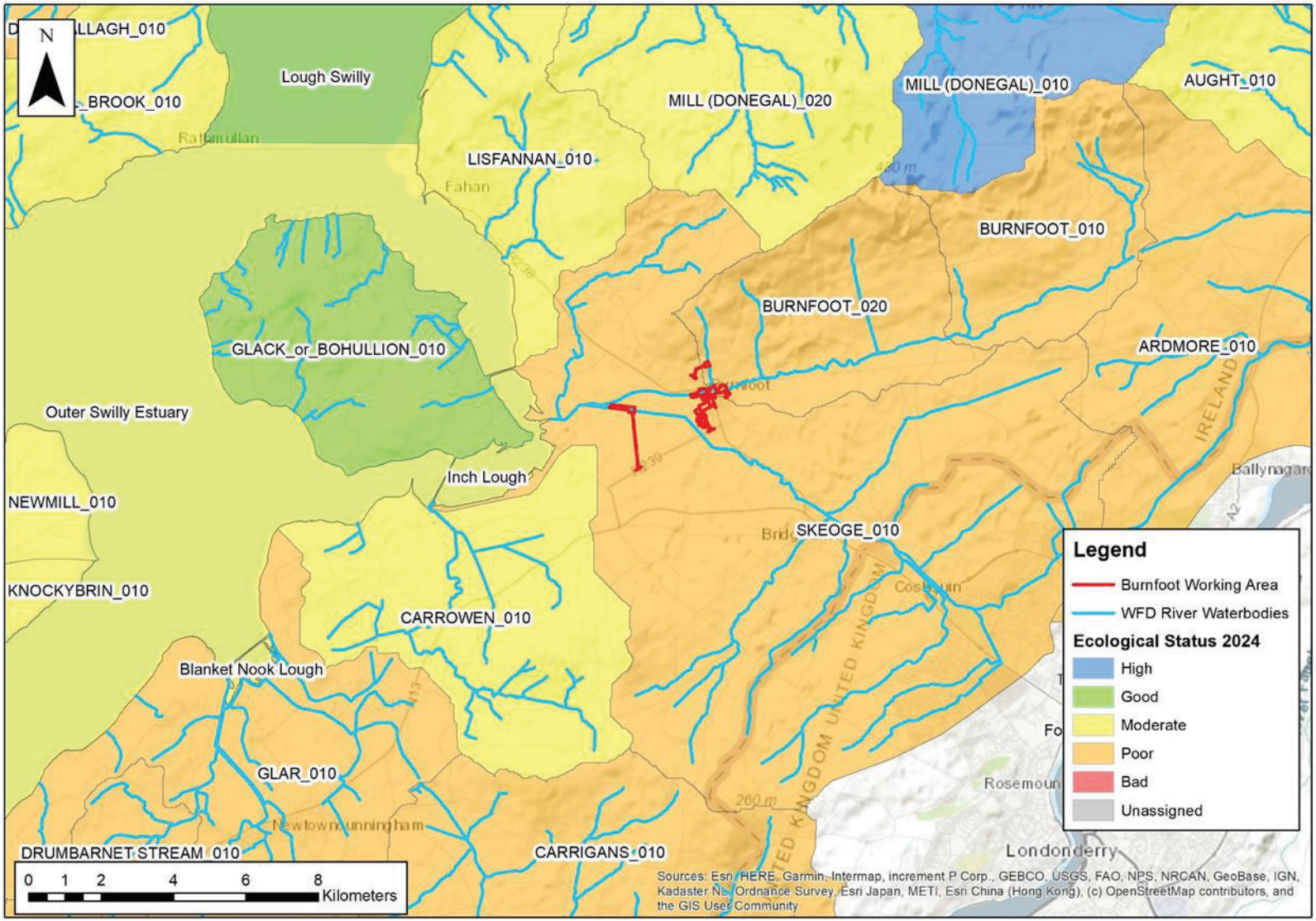

Figure 3.1: Location of proposed flood relief scheme in surface water environment and WFD Water Body Status 2024

3.2 Protected areas

3.2.1 Natura 2000 Protected Areas

Article 3 of the Habitats Directive (92/43/EEC, as amended) requires the establishment of a European network of important high-quality conservation sites known as Special Areas Conservation (SACs) that will contribute to conserving habitats and species identified in Annexes I and II of the Directive. The listed habitat types and species are those considered to be most in need of conservation at a European level (excluding birds). In accordance with Article 4 of the EC Birds Directive (2009/147/EC), Special Protection Areas (SPAs) are strictly protected sites classified for rare and vulnerable birds (Annex I of the Directive), and for regularly occurring migratory species.

Lough Swilly SAC (002287) and SPA (004075) are located within the boundaries of the proposed works (Figure 3.1).

Lough Swilly SAC (002287) was designated in October 2018 and parts of the proposed flood relief scheme fall within the boundary of the SAC. The qualifying features for this European designated site are:

- Estuaries [1130]
- Coastal Lagoons [1150]
- Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) [1330]
- Otter (*Lutra lutra*) [1355]
- Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles [91A0]
- Molinia meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*) [6410]

The SAC includes all of the inner part of Lough Swilly and is estuarine in character, with shallow water, intertidal sand and mud flats being the dominant habitat. It covers the brackish lake of Inch Lough. The site also contains breeding *Lutra* and has one of the best examples of a shallow, low salinity lagoon in the country.

Lough Swilly SPA (004075) was classified in November 1995. Parts of the proposed flood relief scheme fall within the boundary of the SPA. The SPA comprises the inner part of Lough Swilly, including Inch Lough. The predominant habitat is a series of extensive sand and mud flats which are exposed at low tide along with improved pasture and arable fields which are important to geese and swans. Total numbers of wintering waterfowl exceed 20,000 birds which grants it international importance.

3.2.2 Designated Shellfish Waters

The Shellfish Waters Directive (2006/113/EC) is implemented in Ireland by the European Communities (Quality of Shellfish Waters) Regulations 2006 (SI No 268 of 2006).

The Lough Swilly shellfish waters are located within 4km downstream of the Proposed Scheme.

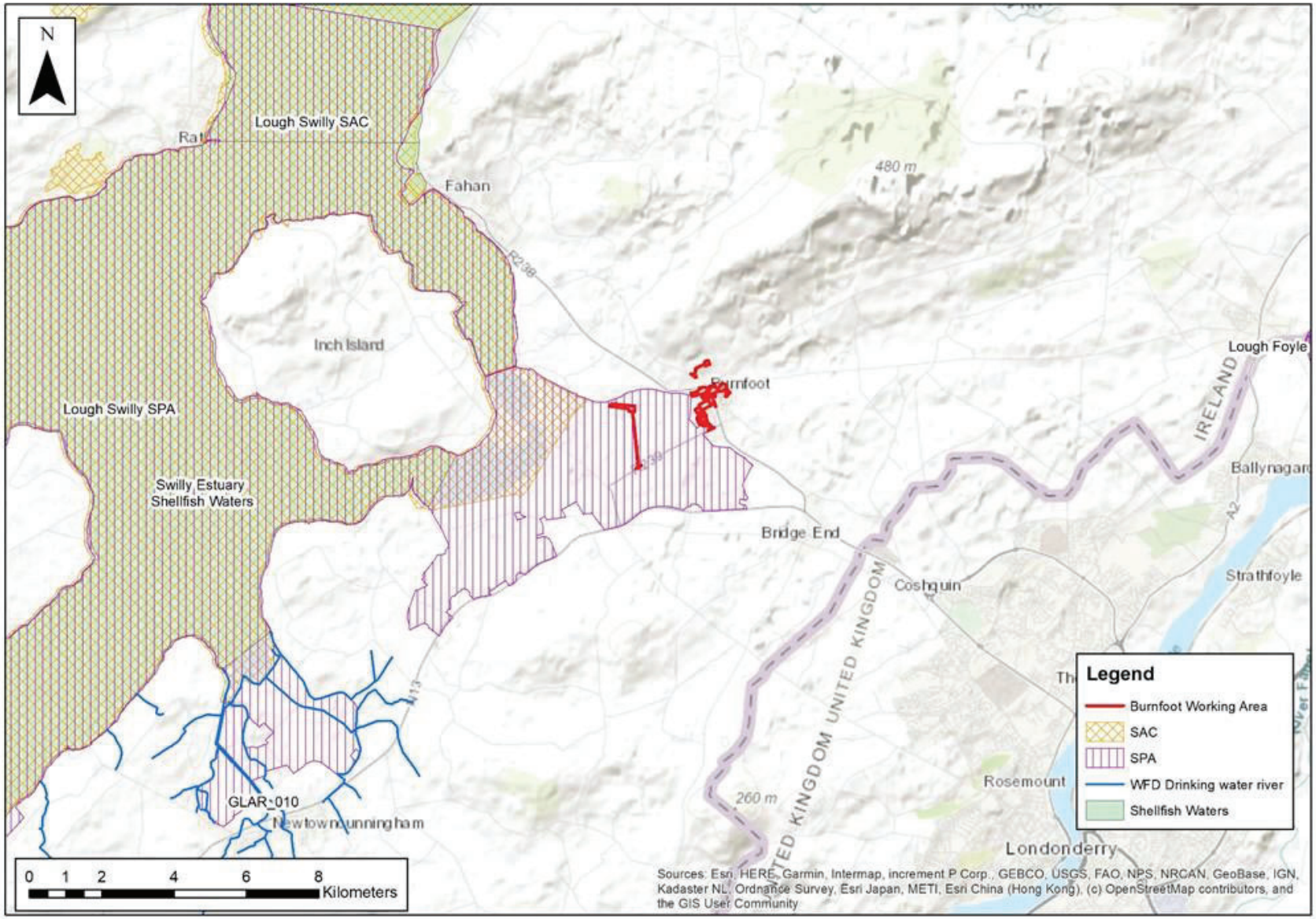

Figure 3.1 WFD protected areas within the boundaries of the proposed maintenance works

4 PROJECT DESCRIPTION

4.1.1 Installation of flood relief measures

To protect Burnfoot village against the 0.5% annual exceedance probability of a fluvial flood event, the proposed scheme consists of a combination of hard defensive measures, culvert improvements, replacement of the R238 road bridge and floodplain reconnection. Hard defensive measures proposed within the scheme include the construction of earthen embankments, flood walls, sheet piled walls, surface water and back drainage works and removal of some existing embankments. To support the development of the proposed scheme, additional working areas, construction compounds, haul routes and site access will also be required. Potential impacts as a result of these activities are mainly due to the alteration to the current channel morphology and water flow regimes as a consequence of the proposed flood relief scheme works.

4.1.2 Construction phase

The activities involved in the construction phase will be carried out according to the outline Construction Method Statement which is included within the Preliminary Buildability and Operations & Maintenance Report. The construction phase consists of the following main elements:

1. Utility Diversions

Where possible, all major utility diversions should be conducted in advance of construction works, although some ESB electrical poles will require permanent relocation to enable the construction of the proposed defences. Other works involving drainage infrastructure are relatively minor and can be accommodated during the defence construction. There are no obvious conflicts between existing utilities and the Proposed Scheme that would require significant enabling works.

2. Site Establishment and Clearance

The Proposed Scheme will be constructed on previously undeveloped land which will require initial clearing of vegetation and trees to create a working strip up to 20 metres in width, installation of temporary fencing surrounding the working area, temporary occupation of rear gardens of properties in Líos Na Gréine and Páirc an Grianán and demolition of an existing stone outbuilding along the Carnashannagh Stream. In addition, construction of a stoned haul road along the length of the proposed embankments to facilitate ongoing maintenance and inspections. To prevent the spread of invasive species as a result of the proposed works, treatment of such species will be required in advance of construction works.

3. Flood Embankment Construction

Flood embankments will be constructed where there is adequate space to facilitate their construction and future maintenance requirements. The construction of the flood embankments will involve the following methodology:

- Stripping and storage of topsoil within the working area for reuse.
- Import and storage of suitable clay material to form the core of the embankment by lorry and road.
- Excavation of a trench will be undertaken by an excavator to a suitable cut-off, and clay placed and compacted in layers until the defences have reached the necessary height.
- Embankment front and back slopes will be profiled to meet the required gradient of 1 in 3. The embankment will then be topsoiled with a suitable, biodegradable geotextile and sown in grass.
- Stockproof fencing will be required where embankments are to be located in agricultural land where grazing is likely.
- For the low bund embankments around the properties on Slab Road there will be localised raising of the access road where the embankments tie into it up to a maximum of 300mm.

4. Flood Wall Construction

Based on geotechnical assessment, it is considered necessary to build sheet pile walls to the rear of Líos Na Greíne and Páirc an Grianán and also on both banks downstream of the Burnfoot Bridge. There are also a number of short sections of reinforced concrete wall which are proposed where insufficient space exists for the construction of a flood embankment. These are located immediately upstream of the bridge to connect the earth embankments and the bridge parapets. There are also two short sections on both banks of the Carnashannagh Stream upstream of the Brae Road. The flood wall on the left bank at this location will tie into the shed which is required to be removed and rebuilt to facilitate construction of the flood wall. These will be constructed from cast in-situ reinforced concrete.

5. R238 Bridge Replacement

Due to the large number of daily vehicle movements which pass through Burnfoot village (the R238 Annual Average Daily Traffic (AADT) flow through Burnfoot is 12,380), a temporary bridge will be required to facilitate the demolition of the R238 bridge and construction of a replacement. As there are residential and commercial properties downstream of the bridge, the only suitable location for the temporary bridge is in the upstream fields. However, these are lower than the existing road and so suitable stone will need to be imported to facilitate the construction of a temporary road extending from Monreagh Park (L-1881) to the north to a suitable point south of the river.

6. Culvert Improvements

On the Carnashannagh Stream, conveyance improvement measures are required in two locations. These works include the construction of a new culvert inlet where the watercourse passes beneath Brae Road/Monreagh Park and a new culvert approximately 400 metres upstream.

The upstream works will require the removal and disposal of the existing culvert using an excavator. At the upstream location, the works will require the removal and disposal of the existing culvert using an excavator and the minor realignment of the stream on approach to the culvert headwall. Eighteen metres of a new, reinforced concrete box culvert of 1.2m high x 2.4m wide will be laid upon imported granular subbase and the works will be completed with a suitable head wall and trash screen and tail wall. These will be precast reinforced concrete structures that can be purchased as standard and set into place.

At the lower location, a box culvert of 1.2m high x 2.4m wide will be required to accommodate future climate change scenario river flows. This culvert will be extended downstream from the Brae Road until it passes beneath the proposed flood embankment from where it will continue in an open channel to the confluence with the Burnfoot river. New headwall structures and debris screens will be provided at proposed flood embankment.

The works will be undertaken during a dry period to ensure low flows. This will facilitate the temporary damming of the river and diversion of the flow via temporary pipes over a short section where work is being undertaken. Consideration will be given to over-pumping to ensure the works remain dry for the placement of the concrete base for the structures.

7. Alterations to the Existing Embankments

To allow for floodplain reconnection, the Proposed Scheme includes removal of two sections of embankment downstream of Burnfoot village. One on the left bank of the Burnfoot River which is part of an existing OPW maintained Arterial Drainage Scheme and the second on the right bank of the Skeoge River which is privately owned. There are also two embankments upstream of Burnfoot Bridge at Monreagh Park that are proposed to be removed to allow reconnection of the flood plain along this reach of the Burnfoot River. These works will involve the simple removal of the embankments using an excavator and dumper/lorry to remove the material from the site.

8. Back Drainage

Flood defences can restrict the ability of the land behind them to drain which can cause it to become waterlogged. To prevent this, construction of a series of land drains behind the defences is required. This will

consist of a series of perforated pipes bedded in no fines granular material and laid parallel to the defence line at the rear toe. Precast concrete manholes will be provided at regular intervals to facilitate access for maintenance or changes in direction. The outfalls of the back drain will discharge to the river via precast concrete headwalls mounted with backflaps to prevent backflow. The outlet pipework will therefore have to pass either beneath embankments or through walls as applicable.

9. Reinstatement

Reinstatement will be undertaken to the entire working area on a like-for-like basis as far as possible. Within areas of open space or agricultural fields, this will be limited to installing some localised lateral drainage to connect into the back drainage, re-grading of the ground, topsoiling and sowing in grass. In residential properties, this will additionally involve the replacement of garden sheds, reinstatement of paving areas, replacement of property boundaries, fences, and planting.

10. Landscaping Proposals

The landscaping proposals include:

- 5837;
- Proposed specimen tree planting, comprised of Heavy Standard Trees of locally appropriate native species;
- Proposed woodland planting areas comprised of locally appropriate native tree and shrub species;
- Proposed areas of grass seeding to proposed Swales;
- Proposed areas of low maintenance grass seeding to embankments;
- Proposed areas of low maintenance grass seeding to remaining areas;
- Pedestrian circulation route, surfaced in resin bound aggregate; and
- Street furniture elements comprised of bench seating and litter bins.

4.1.3 Operational phase

As the main elements of the Proposed Scheme are hard defences, culvert improvements and a bridge replacement there are no unusual or specialist maintenance or operational activities envisaged. Inspections, cleaning, and maintenance works including any necessary repairs completed in accordance with standard asset management procedures, will be the main operational activities.

- Defence walls (Piled and RC) – maintenance regarding these will be minimal. Inspections in accordance with standard asset management procedures are likely to be the main activities. Dealing with vandalism (graffiti or damage) to capping stones can be an issue. This will require access to private gardens and properties, especially at the rear of Líos Na Greíne and Páirc an Grianán.
- Flood Embankments – these will need regular inspection and should be mowed at least twice annually to prevent growth of significant vegetation. Inspection activities will need to look for presences of animal burrowing or damage from livestock through fencing of the defences, where located within agricultural fields should prevent the latter. Access to embankments is easily achieved for both inspection and maintenance purposes. It is envisaged that embankments adjacent to the R238 bridge will be maintained by a ride on or pushed mower whereas the agricultural embankments may be cut by tractor mounted flail.
- Culverts – Inlet structures and screens will need regular inspection and cleaning. This is particularly important prior to and post significant rainfall events. The inlet structures will be designed to facilitate ease of access for cleaning and removal of debris.
- Drainage elements – Flap valves will need checked regularly to ensure they are working as they form a key aspect of Scheme function. These will be designed in such a way to provide safe access. This can be within a manhole on the defended side of the defences rather than at the point of outfall to the river. Back drainage will need to be checked for blockage and rodded if necessary. Manholes will be provided

to enable this to happen. These manholes will be located on private property including residential gardens and agricultural land. Although potential road drainage improvements will only be confirmed at the design stage, their maintenance will be required for these elements. Swales will require little maintenance; however, it is important to inspect for any obstructions in the channel which may hinder flows or that may be conveyed into the Carnashannagh Stream / Burnfoot River, as well as management of vegetation growth within the channel.

- Bridge – The bridge will be maintained by Donegal Council Roads in accordance with their inspection and asset management procedures. Detailed design of the bridge will consider any requirements in this regard but there is not envisaged to be any unique challenges specific to Burnfoot.

Potential impacts during the maintenance works are mainly linked to a potential risk of the leaching of sediment-bound nutrients and the release of fine sediment plumes. Excavation of material from the channel and channel banks is one of the proposed measures to be undertaken across the full extent of the Proposed Scheme and the impacts associated with this must be assessed further.

5 WATER STATUS IMPACT ASSESSMENT (WSIA)

5.1 Stage 1: Screening

In line with guidance from the RBMP Guidelines, the proposed works have been screened for WSIA on the basis of the source pathway receptor model.

Source – The nature of the works will result in a direct impact on the water bodies affected and the types of activities could potentially have a significant impact on the hydromorphological supporting condition of the water bodies affected.

Pathway – As the activities are proposed within the channel and the adjacent riparian zone there is a direct pathway to the receptor;

Receptor – There are a number of the contributing elements of ecological status that could be impacted, particularly the supporting hydromorphological supporting conditions and the biological elements.

Based on the S-P-R model the proposed flood relief scheme has been **screened in** for WSIA.

5.2 Stage 2: Scoping

This section summarises the potential impacts associated with the maintenance activities. The potential risks to each of the key receptor groups are considered.

5.2.1 Scoping summary

The scoping assessment has been applied for the flood relief measures identified in Chapter 4, Project Description. The potential impacts for each activity have informed the selection of the activities which are scoped into the assessment.

It is necessary to identify links between the proposed development and every quality element that could be affected. It is also necessary at this stage to consider activities and how they affect the morphological mitigation measures for those waterbodies, where applicable. Indeed, the scoping assessment has established that there is a significant risk to the hydromorphological supporting conditions and therefore the supplementary Morphological Risk Assessment guidance has also been applied to the flood relief measures, this is presented in the detailed assessment.

For all activities, the scoping phase involves considering each WFD quality element to identify where a possible causal link between the quality element and the activity exists. That is, where water body status or objectives could be affected at water body level by the proposed activities.

5.3 Stage 3: Impact Assessment

Based on the outcomes of the Stage 2 scoping assessment, this impact assessment establishes whether the activities associated with the proposed works on the Burnfoot flood relief scheme will:

- Prevent the achievement of WFD status objectives;
- Cause deterioration in water body status; and/or
- Impinge upon protected areas designated under the European Directives listed in Article 5 of the WFD.

This is the stage of the assessment where evidence is provided to demonstrate that the proposed works are compliant. Specifically, for each quality element it must be shown that the activities scoped into the assessment will not cause a deterioration in status nor prevent the achievement of WFD status objectives. Where appropriate it is also the stage where design mitigation, aimed at reducing the effect of an activity, is discussed.

Information contained within Section 4 has formed the basis of the WSIA assessment.

Table 5.1 Stage 2 scoping summary

Receptor	Potential risk to receptor?	Note the risk issue(s) for impact assessment
Biology: macroinvertebrates	Yes	Macroinvertebrate communities could be affected by the release of fine sediment into the water column from construction activities which can limit light penetration, cause the filling in of potential habitats (losing microhabitats) and change the availability of certain foods. The physical changes to the water body in terms of the hydrological regime and the morphological impacts could impact on the biology also. Hazardous substances resulting from spillages of oil and chemicals used during construction could also have a significant effect.
Biology: Fish	Yes	There are records of sea trout and Atlantic Salmon within the Burnfoot river. Construction activities have the potential to create sediment plumes in the water channel. This can lead to lower dissolved oxygen concentrations, the infilling of interstitial spaces necessary for egg laying. The works may also result in an increase in water velocity.
Water Quality (Physico-chemical_	Yes	There is the potential for an impact on nutrient loading, BOD and DO levels from construction run-off, particularly when sediment is disturbed during construction of culverts, bridges and removal of embankments..
Water Quality (Chemical)	Yes	Burnfoot River failed in its most recent chemical status assessment (2016-2021 WFD reporting cycle) due to high levels of benzo(a)pyrene. The monitoring station in the Burnfoot River is located at Burnfoot Bridge which is to be replaced as part of the proposed scheme. Possible sources of benzo(a)pyrene include road traffic emissions and incomplete burning of wood and coal. The FRS will not increase road traffic volumes or increase burning of fossil fuels, it is therefore unlikely to result in any further operational impacts. A broad range of potential pollutants, such as hydrocarbons i.e. fuels can accumulate on surfaces. These can subsequently be washed off during high rainfall/ storm events, polluting the receiving waterbodies and potential impacting on the chemical status of the water body and should therefore be assessed further.
Protected Areas	Yes	The flood relief scheme is within the boundaries of Lough Swilly SAC (00287) & SPA (004075).
Invasive non-native species	Yes	Throughout the Skeoge and Burnfoot Rivers there are records of Invasive Non-Native Species (INNS) including Himalayan Balsam, Montbretia, Giant rhubarb and Snowberry.
Hydromorphology	Yes	The structure of the channel and the riparian zone may be impacted during the construction of culvert improvement works, flood walls, replacement of a new bridge new embankments and removal of some existing embankments to reconnect the floodplains downstream of Burnfoot village. Depending on the scale of the temporary works and the permanent structures this could alter the hydromorphological supporting conditions of the water bodies affected.

5.3.1 Biology (macroinvertebrates)

Data from the North-West Greenway collected in May 2020 for the lower Burnfoot/ Skeoge below the confluence of both rivers was assigned a Q-value of 2-3, indicative of Poor ecological quality and moderate to heavy pollution. This was partly expected because the site was too deep to wade safely, such that sampling

occurred via a kick sweep in marginal vegetation. The bed was observed largely to comprise fine material such as fines, silt and mud, and this is reflected in the Q-value score.

Similarly, historical data from the NW Greenway for the site on the Skeoge River just above its confluence with the Burnfoot River was also assigned a Q-value of 2-3, indicative of Poor ecological quality and moderate to heavy pollution. This score also reflects the deep and sluggishly flowing modified channel section here, which is adjacent to the area of the proposed embankment removal. The Q-value is also the same as that reported by the EPA for their biological sampling conducted in 2023 at a site 1.8km upstream (station code RS39S010300).

The Burnfoot River downstream of the R238 road bridge survey section covers the main option locations for hard engineering for flood management i.e., within most of the Proposed Scheme area. The moderate ecological quality (Q-value of 3-4) observed at this site was consistent with Q-values reported by the EPA for the same site in 2023. This score likely due to the channel's lack of physical diversity, high fine sediment cover and poor in-stream physical substrate. Invertebrate communities were mainly represented by moderately pollution tolerant taxa such as gammarids, dipteran larvae, caseless caddis, and small mud-snails. However, the presence of small numbers of pollution sensitive taxa such as Heptageniid mayfly nymphs and Chloroperlid stonefly nymphs is reflective of the shallower depth, faster flows and slightly improved ecological quality as compared to the Skeoge.

The middle Burnfoot River upstream of the Proposed Scheme area was surveyed as a control site and had poorer quality (Q-value 3) indicative of moderate pollution. Although fine sediment levels were low, there were patches of silt and the substrate was dominated by finer materials. More distantly upstream of the Proposed Scheme, the Upper Burnfoot was assigned a Q-value of 3-4, and of moderate ecological quality. The score is not consistent with EPA monitoring data for the most recent monitoring undertaken in 2023, which assigned a Q-value of 2-3, which represents a decline from moderate to poor ecological condition due to a serious outbreak of 'sewage fungus', a bacterial growth caused by organic pollution.

The Carnashannagh Stream was surveyed both upstream and downstream of the upper proposed culvert for benthic macroinvertebrates and physical habitat. Both sites were assigned Q values of 3-4 which is indicative of moderate ecological quality and slight pollution. The downstream site (up to 1m wide) had a relatively coarse substrate of cobble and boulder with scattered gravels. While the true right bank was open to sheep grazing, the stream bed was clean and free of fine sediment although patches of sludge were visible. The upstream site was narrower (approx. 0.25m wide) and overgrown in places before opening up to run along the edge of a farm track. The stream side is bounded by a constructed concrete wall up to 1m high along its true right bank.

Overall the quality of the physical habitat and nutrient and organic pressures along these reaches mean that the ecological status of these reaches is moderate at best but more commonly poor. Altered flow regime and hydromorphological conditions are one of the significant pressures impacting on the biology of the river.

It is envisaged that embankment removal to reconnect the floodplain along the Skeoge River may in-fact assist in the recovery of the river through improvement in channel morphology and flow regime to a more natural state. While it is unlikely the river will be able to attain good ecological status, however the mitigation measures applied through the new guidance should assist in attaining good ecological potential if the Skeoge River is classified as a heavily modified water body (HMWB), it has been recommended by the EPA to be considered for such a designation given the arterial drainage scheme in this sub-catchment.

The main risks to macro-invertebrates are possible fine sediment runoff/ entrainment and the potential for spillage or release to watercourses of plant fuel, oils, concrete, or other polluting substances during the construction phase and habitat loss during the operational phase. Sediment run-off reduces water clarity and can reduce the physical habitat quality for macro-invertebrates and fish. Possible sources include excavations associated with construction/ removal of embankments, deconstruction and replacement of the Burnfoot Bridge, upgrading of existing culverts (Carnashanagh Stream), spoil storage areas, flow diversion channels for surface water drainage works, stockpiling of soils and excavated materials, plant movement/ disturbance, and installation of sheet piling/ reinforced concrete walls. Other pollutants may originate from spillage or

release to watercourses of plant fuel, oils, concrete, or other polluting substances which may have both lethal (direct mortality through toxicity) and sub-lethal (reduced respiration, growth, reproduction) effects on fish, invertebrates and their habitats.

As ecological quality within the Burnfoot an Skeoge water bodies range from moderate to poor and with the recommended mitigation measures in place the probability of residual impacts from run-off of fine sediment, and the release of other pollutants, is unlikely and there should be no risk to the deterioration in ecological status due to the proposed works.

5.3.2 Biology (Fish)

The Lower Skeoge river is embanked, straightened/ historically drained, moderately deep and slow flowing with a dominance of emergent and submerged vegetation. On-site assessment as part of the Burnfoot FRS baseline assessment showed that fine sediment cover was moderately high while substrate was of intermediate coarseness due to a mixture of cobble, pebble and fines, but the coarseness index value was below levels associated with good salmonid habitat.

The Lower Burnfoot River in the vicinity is partly embanked, historically straightened/ dredged, and shallow with high levels of fine sediment cover. Coarseness was low to moderate due to a dominance of pebbles and fine sediment and a few in-stream cobbles/ boulder. Both sediment cover and substrate quality were consistent with degraded ecological quality and poor salmonid habitat quality.

The lower Skeoge River above the footbridge was much deeper and of low habitat quality due to high levels of bed sediment and extensive macrophyte growths. Sediment cover far exceeded levels at which benthic community diversity is compromised while the depth and flow were unsuitable for juvenile salmonids.

Below the confluence of the Burnfoot River and downstream of the footbridge the channel deepens markedly and is unsafe for wading. The riverbed was dominated by deep silt while flow was sluggish and macrophyte growth extensive. This section was not suitable for salmonids but would act as a migratory corridor for sea trout and eels between the Skeoge/ Burnfoot and Inch Lough.

5.3.2.1 Salmon and trout stock data

In Northern Ireland, the Skeoge River is within the jurisdiction of DAERA IFD, and in the Republic of Ireland, within the jurisdiction of IFI. There is no data indicating the presence of salmon within the Skeoge River catchment. Although brown trout are known to be present in the Skeoge and Burnfoot, with anecdotal reports of sea trout runs.

5.3.2.1.1 Juvenile salmonid stocks

Juvenile salmon and trout stock data was available for the Burnfoot River for 2015 from IFI's WFD fish monitoring programme for rivers; this included data from two sites, one immediately downstream of Burnfoot Bridge in Burnfoot, and a site ca. 2km upstream and above the Proposed Scheme area. These data, expressed as a minimum density, showed that salmon Aged 0 and Aged 1 were respectively absent and present at very low densities below Burnfoot Bridge, and both age-classes present at low densities 2km upstream of Burnfoot. A more extensive distribution of salmon is possible within the Burnfoot River; for example, based on older data reported from IFI CWEF surveys for 2008 and 2010; salmon fry (Aged 0) were present from the Burnfoot Bridge to Glen Bridge just over 2km upstream at Poor to Fair abundance, and absent at a series of survey sites from over 3km to 7km upstream.

Trout fry were more widely distributed, present at Good to Excellent abundance throughout the river from Burnfoot village to over 7km upstream. Under verbal agreement with Donegal County Council (DCC), data from fish surveys conducted in May 2020 for the EIAR for the proposed North-West Greenway, are presented for a site on the lower Burnfoot just upstream of its confluence with the main Skeoge; salmon and trout fry were absent here, although Age 1 and older trout were present at moderate abundance. The presence of 3 sea trout smolts in this lower river location is consistent with the survey timing (May 2020) and anecdotal information regarding the use of Inch Lough (located downstream) as sea trout angling location, and the ability

of both trout and eel to pass from Lough Swilly through the tidal barrier. Dominance of Aged 1 and greater trout is unsurprising here since no obvious local spawning habitat was observed with mainly bedrock producing poor nursery habitat. It is highly likely that the presence of sea trout smolts reflects their downstream movement from better quality spawning and nursery rearing areas upstream, with fish moving downstream as they age and undergo the smoltifcation process.

These data demonstrate that salmon spawning has occurred in the Burnfoot River at least as far downstream as below Burnfoot Bridge, with spawning having occurred throughout the middle reaches of the river in the areas of the proposed hard defences. Trout spawning and recruitment is dominant over that of salmon, and extends throughout the river from Burnfoot village upstream and in the vicinity of the uppermost Proposed Scheme works.

No data from fish surveys was available from IFI for the lower Skeoge River. However, data from a single survey site conducted in 2019 was available for the Skeoge River upstream of the area of the proposed embankment removal from baseline data conducted for the North-West Greenway. Salmon and trout fry were absent at this location (Figure 6.2), although three Age 1 and older trout were present. This observation is consistent with the deep and sluggishly flowing section of the lower Skeoge, which is largely holding water with no apparent spawning and little obvious nursery habitat. However, the lower Skeoge River is most likely used by ascending adult fish that move upstream to spawn and the possibility that some sea trout also move upstream to spawn cannot be ruled out.

Table 5.2: Juvenile salmon and trout minimum density (no./m^2) in the Burnfoot River in 2015 (Source: IFI).

	Aged 0 trout	Aged 1+ trout	Aged 0 salmon	Aged 1+ salmon
Burnfoot – Burnfoot Br.	0	0.114	0	0.01
Burnfoot – 2km u/s Burnfoot Br.	0.017	0.145	0.006	0.011
Other fish species present at both sites: lamprey spp., eel, 3-spined stickleback				

The juvenile fish stock survey conducted in the field, encompassed 7 sites; three on the Carnashanagh, and four on the Burnfoot River. Salmon were absent at all of the sites surveyed, with the results contrasting historical data of low salmon fry abundance. Trout fry were also absent in the Carnashanagh Stream with the absence above the lower culvert possibly explained by this impassable barrier to fish passage. However, the lack of any trout in the short stretch downstream towards the confluence with the Burnfoot River (where passage from the larger river is unimpeded) may be due to the limited habitat quality in this section.

In contrast, trout fry occurred at all four sites sampled within the Burnfoot River, including the “impact” site 1 below Burnfoot Bridge, where abundance was classified at Good (Table 5.3). Above the Proposed Scheme area, trout fry occurred at Excellent abundance at all of the remaining sites sampled. Overall, the data indicate that brown trout are widely distributed in the Burnfoot River, consistent with historical IFI data.

In addition, Annex II-listed lamprey spp., most likely brook or river lamprey, were found in moderate abundance at site 1 – impact, below Burnfoot Bridge, and in the middle Burnfoot River above the Proposed Scheme area at site 3 – control. At site 1- impact, the lamprey occurred at a range of lengths from the ammocoete stage to transformers (adult). This indicates that lamprey spp. are likely to be widely distributed in the Burnfoot River and are spawning, with nursery rearing habitat at least present downstream of Burnfoot Bridge.

Table 5.3: Summary results of electrofishing survey, indicating adjusted numbers of age 0 and older trout and salmon caught at each site.

Site	Stream	Trout		Salmon		Other fish species
		Age 0	Age ≥1	Age 0	Age >1	
1-impact	Burnfoot River	10	1	10	1	9 lamprey, c. 6-13cm
2-control	Burnfoot River	32	4	32	4	
3-control	Burnfoot River	28	4	28	4	
4-control	Burnfoot River	24	2	24	2	2 lamprey
5-impact	Carnashannagh Stream	0	0	0	0	
6-impact	Carnashannagh Stream	0	0	0	0	
7-control	Carnashannagh Stream	0	0	0	0	

5.3.2.1.2 Lamprey

There are three species of lamprey in Ireland:

- Brook lamprey (*Lampetra planeri*);
- River lamprey (Lampetra fluviatilis);
- Sea lamprey (Petromyzon marinus).

Sea and River lampreys are parasitic and migrate between the freshwater and marine environments, returning to freshwater to breed. In contrast, Brook lamprey are resident freshwater throughout their life cycle and are non-parasitic. Brook lamprey are widely distributed in Northern Ireland but River and Sea lamprey have a more limited distribution (Goodwin et al., 2009). Adult river and brook lamprey tend to have similar habitat requirements during spawning to that of salmonids, using silt-free gravel and pebble areas in shallow running water (Maitland, 2003).

All three species are designated under Annex II of the EU Habitats Directive (Directive 92/43/EEC). None of the three species is listed as a site selection feature of Lough Swilly SAC although unidentified lamprey spp. were present in the WFD fish surveys conducted in the Burnfoot River in 2015 by IFI in the vicinity of Burnfoot village and further upstream (Kelly et al., 2015). In addition lamprey were present during surveys under taken as part of the Burnfoot FRS baseline downstream of the R238 bridge in good flowing riffle/run and glide habitat. There is no information on their presence in the main Skeoge downstream of the Burnfoot confluence

5.3.2.1.3 European Eel

As a result of continual decline in the European eel stock throughout its range, the European Commission introduced the Eel Recovery Plan (Council Regulation No 1100/2007) which aims to return the European eel stock to more sustainable levels. Member States are required to establish national Eel Management Plans to achieve a 40% escapement of silver eel to sea as potential spawning stock. Member States are also required to implement Eel Management Plans for the recovery of the stock through action by specific measures in each eel river basin, in this case the North Western International River Basin District. The European eel is not listed in the EC Habitats Directive but because of the aforementioned population decline has recently been added to the International Union for Conservation of Nature (IUCN) Red List of Threatened Species in the category of Critically Endangered (King et al. 2011).

Detailed distributional data of eel in watercourses in the drainage scheme extents is limited. Eel presence was confirmed in the Burnfoot River in the vicinity of Burnfoot village and further upstream in the surveys conducted

for WFD monitoring by IFI (Kelly et al., 2015). However no eels were present during the electrofishing conducted as part of the Burnfoot FRS baseline

Throughout the Skeoge River there is generally very poor in-stream physical habitat quality, with high levels of riverbed fine sediment largely of silt. Sediment cover far exceeded levels at which benthic community diversity is compromised while the depth and flow were unsuitable for juvenile salmonids. The lower sections of the Burnfoot River are heavily silted, sluggish flow and have extensive macrophyte growth and would not be suitable for salmonids but would act as a migratory corridor for sea trout and eels between the Skeoge/ Burnfoot and Inch Lough. The nature of the channel and the condition of the habitat have been impacted by historical drainage works and alterations to the morphology of the river, the current ecological status of both rivers is poor with the macroinvertebrate community driving the status classification.

The main risk to fish stocks include fine sediment loss, release of pollutants, temporary obstruction of fish passages, loss or crushing of sensitive species or fish at sensitive life stages and noise and vibration during the construction phase. During the operational phase, risks include habitat loss where hard defences have been installed and permanent obstruction of fish passage. However, the planned replacement of the existing Burnfoot Bridge with a new clear span bridge would not pose any impact on fish passage because no structure will be placed in the main channel. In addition, the lack of fish in the Carnashannagh Stream means that impacts on fish will not occur as a result of the proposed culvert upgrades, which will also be constructed following a design which will allow fish to migrate unimpeded. Assessment of possible impacts has concluded that following the appropriate application of proposed mitigation measures, the impact of the proposed works on fish stocks will be negligible.

5.3.3 Water Quality (Physico-chemical)

The physio-chemical supporting elements for the Skeoge_010, Burnfoot_020 and Inch Lough are included in Table 5.4 and Table 5.5 below

Table 5.4: River water body WFD status breakdown

WFD Status 2019-2024			***Burnfoot_010***	***Burnfoot_020***	***Skeoge_010***
			NW_39B020200	***NW_39B020600***	***UKGBNI1NW393901002***
Ecological Status	*Biological Status*	*Phytobenthos Status*	*Not available*	*Good*	*Not available*
		Angiosperm (seagrass) Status	*Not available*	*Not available*	*Not available*
		Macroalgae Status	*Not available*	*Not available*	*Not available*
		Invertebrate Status	*Poor*	*Poor*	*Poor*
		Fish Status	*Not available*	*Poor*	*Moderate*
	Supporting Chemistry Conditions	*Oxygenation Conditions*	*Not available*	*Pass*	*Not available*
		Nitrogen Conditions	*Not available*	*High*	*Not available*
		Phosphorus conditions	*Not available*	*High*	*Not available*
	Hydromorphological Quality Element	*Hydrology, Morphology, Continuity*	*Not available*	*Not available*	*Not available*
	Ecological Status (2019 – 2024)		**Poor**	**Poor**	**Poor**
Chemical Status	*Specific Pollutant Conditions*		*Not available*	*Pass*	*Not available*
	Chemical Status (2019 – 2024)		*Not available*	*Not available*	*Not available*
Overall WFD Quality Status 2019 - 2021			**Poor**	**Poor**	**Poor**

Table 5.5: Transitional water body WFD status breakdown

WFD Status 2019-2024			*Inch Lough*
			NW_220_0300
Ecological Status	*Biological Status*	*Phytoplankton Status*	*Not available*
		Angiosperm (seagrass) Status	*Not available*
		Invertebrate Status	*Moderate*
		Other Aquatic Flora Status	*Good*
	Supporting Chemistry Conditions	*Oxygenation Conditions*	*Not available*
		Nutrients Condition	*Not available*
		Phosphorus conditions	*Not available*
	Hydromorphological Quality Element	*Hydrology, Morphology, Continuity*	*Not available*
	Ecological Status (2019 – 2024)		**Moderate**
Chemical Status	*Specific Pollutant Conditions*		*Not available*
	Chemical Status (2019 – 2024)		*Not available*
Overall WFD Quality Status 2019 - 2024			**Moderate**

Whilst there is no official classification for physico-chemical supporting conditions in the Burnfoot_010, Skeoge_010 or Inch Lough available for WFD cycle 3, in 2024, the EPA published the Water Quality in 2023, An Indicators Report. Which provides an overview of a range of water quality indicators.

For the receiving downstream transitional water bodies of Inch Lough and the Lough Swilly Estuary, the Indicators report provides a three-year average of nutrient concentrations between 2021 and 2023. For transitional water bodies, the indicator for Nitrogen is based on winter dissolved inorganic nitrogen (DIN) levels. Salinity related thresholds have been defined for DIN in estuaries and coastal waters, the thresholds range from 2.6 mg/l N in freshwater to 0.25 mg/l N in fully saline waters. For the water bodies downstream of the Burnfoot FRS, DIN levels for 2021-2023 were more than 50% below the threshold limit. Salinity related thresholds have also been defined for phosphate in estuaries and coastal waters. The thresholds range from 0.060 mg/l P for fresh and intermediate salinity waters to 0.040 mg/l P for fully saline waters. Phosphate concentrations above these thresholds can indicate pollution. For the water bodies downstream of the Burnfoot FRS, P levels were also more than 50% below the threshold limit for the 2021-2023 monitoring period.

In 2025, the EPA published the Water Quality in Ireland 2019-2024 Report which sets out the latest assessment of the health of Ireland's rivers, lakes, canals, groundwaters, transitional (estuaries) and coastal waters. Up to date details of monitored physico-chemical parameters are available through the EPA's Eden Portal. Although there are no environmental quality standards set for nitrate in rivers, average concentrations of less than 4mg/l NO_3 (0.9mg/l N) and 8mg/l NO_3 (1.8mg/l N) are considered to be indicative of high and good quality by the EPA respectively. Table 5.6 below displays the levels recorded within the river waterbody sections during the most recent monitoring period published, 2019-2024 and including 2025 data. The Burnfoot_020 mean concentration of 0.96 mg/l indicates good quality for this parameter.

Trend analysis for 2010-2015 total oxidised nitrogen was available for two monitoring stations of the Skeoge_010, RS39S010050 and RS39S010300. Both stations recorded upwards trends, although neither were statistically significant. Similarly, both were representative of good indicative quality, with baseline conditions of 1.31 and 0.554 mg/l respectively recorded in 2014.

Table 5.6: Summary of Total Oxidised Nitrogen (as N) mg/l concentrations at the river sections during 2019-2025 (Monitoring stations Bridge in Burnfoot - RS39B020600).

Total Oxidised Nitrogen (as N) mg/l	Burnfoot_020	Skeoge_010
Min	0.10	N/A
Max	2.20	N/A
Mean	0.96	N/A
5%ile	0.47	N/A
95%ile	1.45	N/A

Environmental quality standards for phosphate levels in Ireland in accordance with the objectives of the WFD have been established. Average concentrations less than 0.025mg/l P and 0.035mg/l P are considered of high and good quality respectively. Mean concentrations above a concentration of 0.035mg/l, which is required to meet good ecological status, are likely to result in nutrient enrichment in the water bodies. The Burnfoot_020 water body is achieving the high status EQS for phosphate based on the mean annual concentrations and the Skeoge_010 water body achieving the good EQS (Table 5.7). For the Skeoge River, this demonstrates an improvement since the last monitoring period where the mean value was 0.050 mg/l. However, both water bodies are close to the threshold limits.

Table 5.7: Summary of Orthophosphate (as P) mg/l concentrations during 2019-2025 (Monitoring stations for Burnfoot_020, Bridge in Burnfoot - RS39B020600 and for Skeoge_010, u/s Burnfoot WWTW- RS39B020570 and d/s Burnfoot WWTW no 2 - RS39B020610).

Orthophosphate (as P) mg/l	Burnfoot_020	Skeoge_010
Min	0.005	0.008
Max	0.083	0.090
Mean	0.022	0.032
5%ile	0.008	0.025
95%ile	0.064	0.075

For ammonia levels, average concentrations less than 0.040 mg/l N and 0.065 mg/l N are considered high and good quality status respectively. For the monitoring period 2021-2023, both water bodies are failing to meet good status EQS (Table 5.8). Elevated levels are often observed downstream of the Burnfoot WWTW.

Trend analysis for 2013-2018 ammonia was available for three monitoring stations of the Burnfoot_020 river, RS39B020600 (Bridge in Burnfoot), RS39B020570 (U/S Burnfoot WWTP) and RS39B020610 (D/S Burnfoot WWTP). All stations recorded upwards trends, although none were statistically significant. Similarly, the site at the bridge in Burnfoot and D/S Burnfoot WWTP both were representative of moderate indicative quality, with baseline conditions of 0.153 mg/l and 0.0.115 mg/l respectively recorded in 2017. While U/S Burnfoot WWTP was representative of good indicative quality, with baseline conditions of 0.047 mg/l.

For the 2019-2025 data, neither the Burnfoot_020 or the Skeoge_010 water body are achieving the good status EQS for ammonia based on the mean annual concentrations (Table 5.7).

Table 5.8: Summary of Ammonia (as N) mg/l concentrations during 2019-2025 (Monitoring stations for Burnfoot_020, Bridge in Burnfoot - RS39B020600 and for Skeoge_010, u/s Burnfoot WWTW- RS39B020570 and d/s Burnfoot WWTW no 2 - RS39B020610).

Ammonia (as N) mg/l	Burnfoot_020	Skeoge_010
Min	0.010	0.008
Max	1.100	1.100
Mean	0.087	0.123
5%ile	0.017	0.008
95%ile	0.283	0.677

For BOD, average concentrations less than 1.3 mg/l O_2 and 1.5 mg/l O_2 are considered high and good quality status respectively. For the 2019-2025 data, both Burnfoot_020 and the Skeoge_010 met the required conditions for high EQS based on annual mean concentrations but were close to the threshold value (Table 5.9).

Table 5.9: Summary of BOD (as O_2) mg/l concentrations during 2019-2025 (Monitoring stations for Burnfoot_020, Bridge in Burnfoot - RS39B020600 and for Skeoge_010, u/s Burnfoot WWTW- RS39B020570 and d/s Burnfoot WWTW no 2 - RS39B020610).

BOD (as O_2) mg/l	Burnfoot_020	Skeoge_010
Min	0.500	0.500
Max	5.600	5.000
Mean	1.287	1.246
5%ile	0.500	0.500
95%ile	3.755	2.500

The works on the Skeoge_010 water body include embankment removal, construction of sheet pile and flood walls and bridge improvements and will be carried out alongside the proposed mitigation measures. Therefore, the proposed works will not have a significant impact on the supporting physico-chemical conditions in the Skeoge_010 water body given the good supporting conditions for orthophosphate and high for BOD as there is unlikely to be significant inputs of sediment bound nutrients to the channel.

The majority of the proposed works are located along the Burnfoot_020 water body. The proposed works will not have a significant impact on the supporting physico-chemical conditions in the Burnfoot_020 water body giving the good supporting conditions for nitrogen and high for phosphorus and BOD, the waterbody is currently failing to meet good status for ammonia which is likely attributed to the Burnfoot WWTW. In addition, the proposed works will be carried out alongside mitigation measures to ensure there are no significant inputs of sediment and sediment bound nutrients to the channel, provided these are implemented correctly. These measures include but are not limited to drainage and measures to control run-off, limiting earthworks to summer months and installation of silt fencing and drainage ditches.

Inch Lough was classified as moderate for the supporting physico-chemical conditions for the 2016-2012 WFD monitoring period (this is the latest available classification for physico-chemical conditions). The works within the Burnfoot_020 and Skeoge_010 waterbodies are unlikely to have an impact on this downstream water body through the release of sediment bound nutrients following the appropriate implementation of the proposed mitigation measures, the good and high EQS for TON and BOD respectively for the Burnfoot_020 waterbody and the limited extent of works proposed for the Skeoge_010 waterbody. Nutrient inputs attributed to Burnfoot WWTW will not be exacerbated by the proposed works.

The potential for the impact of suspended solids in the context of the hydromorphology of the channel is addressed in the Morphological Risk assessment (Section 5.3.5 and Appendix 1) and the timing of any in-channel works under the guidance will ensure the temporary impact on the fisheries is not significant.

5.3.4 Protected Area Objectives

The Lough Swilly SAC/SPA have been identified as the only relevant European sites that could be impacted by the Proposed Scheme. The water dependent objectives for the Skeoge_010 waterbody and Inch Lough are currently in draft form based on the 3rd Cycle environmental objectives assessment as outlined in the EPA's WFD App. Works involved in the Proposed Scheme will be conducted alongside mitigations recommended in the NIS which include recommendations for surface water and water quality management, invasive species management during construction of the proposed development, in addition to proposed design features to alleviate the potential for increased flood flows within the Lough Swilly SPA and aspects of the proposed bridge design which will allow for safe passage of otter along the Burnfoot River. Provided the full implementation of mitigation measures is carried out, it is envisaged that there will be no significant residual effects on the integrity of the Lough Swilly SAC/SPA.

5.3.5 Hydromorphology

Given the nature of the works, there is a significant risk to the supporting hydromorphological conditions of the Skeoge_010 and Burnfoot_020 river water bodies and hydromorphology has been scoped into the WSIA. As required by the RBMP guidelines it is necessary to undertake a Morphological Risk Assessment based on the supplementary technical guidance that supports the main guidance. This morphological risk assessment, using the MQI-Ireland index is included in Appendix 1.

The iteration of the MQI-Ireland tool (version 1.08.01) used provides a scoring on a reach by reach basis for each river water body. The relevant reaches for the river water bodies is provided in Table 5.10.

Table 5.10: MQI Reaches for the Burnfoot_020 and the Skeoge_020

River Water Body	MQI Reaches	Location	MQI Score	Hydromorphological quality
Burnfoot_020	39_FU_PC_Sin_118,	Carnashannagh Stream	62.09%	Good
	39_FU_UC_Str_120	Burnfoot River upstream of Carnashanagh Stream Confluence extending to Monreagh Stream upstream of the FRS extents	67.78%	Good
Skeoge_010	39_FU_UC_Str_121	Burnfoot River from confluence with the Skeoge River to the confluence with the Carnashannagh Stream upstream of bridge in Burnfoot	36.37%	Poor
	39_FU_UC_Str_123	Skeoge River from confluence of the Burnfoot River too the Slab Road	34.48%	Poor

The MQI tool provides an assessment of a number of different indicators as presented in Appendix A. The current MQI score attributed to the relevant reaches in Table 5.10 indicate that the Burnfoot_020 and the Skeoge_10 river water bodies have good and poor hydromorphological quality respectively.

The Skeoge_010 river water body is included within the OPW Arterial Drianage Scheme and has been imapcted by channel straightening and over deepening historically. As a result the Skeoge_010 is identiifed as a candidate Heavily Modified Water body in the 3rd River Basoin Management Plan. This means that the water body cannot acheive good ecological status wthout compromising the specified use and therefore the objective is to acheive good ecological potential.

The Burnfoot_020 River water body is currently indicative of good hydromorphological quality. The morphological risk assessment as presented in Appendix A has scoped each of the hydromorphological indicators pre and post FRS and has determined whether there is likely to be a change to the supporting hydromorphological conditions of the two water bodies. A summary of the outcome of the assessment is provided below

5.3.5.1 Burnfoot_020

There are two main MQI reaches within the FRS extents within this water body, the Carnashannagh Stream (39_FU_PC_Sin_118) and the Burnfoot River upstream of the Carnshannagh Stream confluence extending to

the Monreagh Stream upstream of the FRS extents (39_FU_UC_Str_120). For the Carnashannagh Stream the improvements in the existing culverts including the removal of the impassible barrier will result in an improvement in the later connectivity (indicators F1 and A4) resulting in a change in high impact to medium impact for these indicators. This will ensure that there will be no deterioration in the supporting hydrommorphologial conditions. The Burnfoot River upstream of the confluence with the Carnashannagh Stream will not be significantly effected as a result of the FRS. This reach is already highlighly impacted due to the presence of existing embankments and property boundaries along the left hand bank of the Burnfoot River along this reach. The introduction of the FRS will not change hydromorphological supporting conditions given that the MQI tool has already assessed this reach as a high impact reach for longnitudinal connectivity (A4) and lateral connectivity (A7) and medium impact for lateral connectivity (A3 and A5) and for riparian condition (F12 and F13). The FRS will not change this assessment.

5.3.5.2 Skeoge_010

There are two main MQI reaches in the Skeoge_010 river water body that will be affected by the FRS, the Burnfoot River from confluence with the Skeoge River to the confluence with the Carnashannagh Stream upstream of bridge in Burnfoot (39_FU_UC_Str_121) and the Skeoge River from confluence of the Burnfoot River too the Slab Road (39_FU_UC_Str_123). For the Burnfoot River the reconnection and rewetting of the floodplain downstream of the village will represent an improvement in the supporting hydromorphological conditions however this will be offset by additional hard defences immediately downstream of the bridge in the Village, therefore this reach will remain as a high impact reach for lateral connectivity and the MQI score will not change signifcantly. The Skoege River will see an improvement in the lateral connectivity with the removal of 345 metres of the embankment on the right hand bank of this reach. Given that there will be no other impacts on the Skeoge River this means there will be an improvement in the supproting hydromorphological conditions.

In terms of the acceptance criteria which must be satisfied in order for a scheme to proceed, as outlined in the Morphological Risk Assessment guidance, the drainage scheme has been assessed as follows

- **There is no change in morphological condition band of any reach directly or indirectly impacted by the proposed development;** There is an improvement in the morphological condition of the Skeoge River (39_FU_UC_Str_123) as a result of FRS however overall there will be no change in the morphological condition of the reaches within or downstream of the FRS extents.
- **There is a decrease in morphological risk score of ≤10%[1] within the morphological condition band (with the exception of those with an existing MQI-Ireland score of less than good, within which zero deterioration is allowed)** (N.B. any reduction in score should not preclude a waterbody from achieving high status); - No deterioration in MQI.
- **The MQI score remains above the bottom quarter of the band (within which zero deterioration is permitted).** The current MQI score in the Carnashannagh Stream is within the bottom quarter of the good hydromorphological quality band however the FRS will result in an improvement in the MQI that takes the score into the 3rd quarter of the condition band.

Under the Morphological Risk Assessment the FRS can proceed as it would assist in improving the supporting hydromorphological conditions from poor to moderate, however it is unlikely that the reaches of the Skeoge_010 river water body would achieve good hydromorphological supporting conditions whilst arterial drainage continues in this catchment.

The River Basin management Plan 2022-2027 acknowledged that *"Initial evidence indicates that there are more waterbodies that have been heavily modified than has previously been designated to date, both within the specified use categories included in the first cycle, and in some of the other specified use categories not previously considered. For example, the number of waterbodies that have been significantly altered in physical character as a result of arterial drainage schemes is significant."* The RBMP also states

[1] This is an arbitrary value which has been taken as a precautionary criteria to allow for screening of an acceptable number of assessments and may be refined through future studies.

"It is important to reiterate, that waterbodies with a heavily modified designation are still expected to meet the required standards for all the other water quality elements, with measures to mitigate to the greatest extent possible the hydromorphological impacts also required."

On this basis a review of the European Commission's Joint Research Centre's report on a common understanding of using mitigation measures for reaching good ecological potential for heavily modified water bodies was undertaken (Bussenttini et al, 2018)[2].

The WFD definition of maximum ecological potential for a HMWB are *"The hydromorphological conditions are consistent with the only impacts on the surface water body being those resulting from the artificial or heavily modified characteristics of the water body once all mitigation measures have been taken to ensure the best approximation to ecological continuum, in particular with respect to migration of fauna and appropriate spawning and breeding grounds"*

In the case of existing flood protection schemes, the HMWB designation process has a built-in obligation to consider alternatives which maintain the benefits for flood protection but are better environmental options. Maintenance or rebuilding of existing infrastructure or maintenance/management is only possible if there are no better environmental options which maintain the flood protection levels. This will need to be considered in any imminent designation of additional HMWB which the EPA and Hydromorphological working group are currently developing. This does not mean that no measures need to be undertaken because all practicable mitigation measures would need to be taken, considering the relevant site-specific circumstances, in particular the potential for ecological improvement.

Therefore the designation of the Skeoge_010 water body as a HMWB, should this occur, means that mitigation measures will need to be applied to address hydromorphological pressures as far is practical whilst still retaining the specified use of the water body, i.e. arterial drainage. To this end the review by the JRC of the EU (Bussenttini et al, 2018[2]) revealed that where measures such as channel re-profiling and vegetation management are commonly mitigated through measures such as increasing the in channel morphological diversity, e.g., creating low flow channel to improve diversity, and selective cutting of vegetation. These measures which are included in the mitigation libraries of many Member States are already included within the OPW Environmental Guidance for Drainage Maintenance and Construction[3] and is therefore consistent with the approaches being adopted throughout Europe to mitigation of hydromorphological impacts as best as possible. Whilst this mitigation may not result in the achievement of good hydromorphological conditions they will ensure that mitigation measures are being undertaken to ensure the achievement of good ecological potential.

What good ecological potential will represent in the HWMB designations will be a decision for the EPA and whilst hydromorphological supporting conditions will be mitigated to the greatest extent possible through the application of mitigation measures, HMWBs will still be expected to meet the required standards for other water quality elements. The introduction of the FRS is not expected to compromise the achievement of these objectives.

[2] Bussettini M, Kling J, van de Bund W, Eds: Kampa E & Bussettini M, Working Group ECOSTAT report on common understanding of using mitigation measures for reaching Good Ecological Potential for heavily modified water bodies - Part 2: Impacted by flood protection structures, EUR 29131 EN; Publications Office of the European Union, Luxembourg, 2018.

[3] https://www.floodinfo.ie/frs/media/filer_public/b0/5a/b05a1126-7de1-4921-bdb2-1c2579470171/environmental_guidance_-_drainage_maintenance_and_construction_2019_web_part-1.pdf

6 SUMMARY

A WSIA has been undertaken for the proposed flood relief scheme located inland around the village of Burnfoot, County Donegal in the Lough Swilly catchment. The assessment is based on the emerging guidelines that are being developed for planning; *The Planning System and River Basin Management – Guidelines for Planning Authorities* (RBMP Guidelines), which aim to more generally support implementation of the WFD through the planning process.

The key focus of the assessment was to ensure that the proposed works does not result in deterioration in the current WFD status based on the 2017 baseline as reported in the Lough Swilly Catchment Assessment 2010-15 and also to ensure that the project does not compromise the achievement of the WFD objectives for the improvement in the overall status of the surface water bodies which could be affected. The assessment also considers the protected areas linked to the water bodies in question and ensures that the protected areas' objectives are also unaffected.

The scoping stage of the WSIA has concluded that there were a number of components and activities associated with the proposed activities that represented a risk to the WFD status and objectives and therefore were scoped into the assessment. The relevant quality elements contributing to the overall status were also considered and how each activity could affect these.

The overall conclusion of the WSIA Assessment, based on the baseline information, the relevant impact assessments and mitigation strategies proposed, is that there will be no risk of deterioration in the existing status of the Burnfoot_020, Skeoge_010 and Inch Lough Water bodies and it is actually likely that with the reconnection of the Skeoge_010 to the flood plain, and improvements to existing barriers to longitudinal connectivity that the hydromorphological condition of the Burnfoot_020 and Skeoge_010 water bodies will improve above the existing situation. However, it is unlikely that the Skeoge_10 water body will be able to achieve the objective of good ecological status due to the hydromorphological supporting conditions and therefore it may be necessary to designate the water body as a HMWB so that the continued arterial drainage measures can be retained whilst striving for the achievement of maximum ecological potential based on the suite of mitigation measures.

Appendix A

Morphological Risk Assessment

1 MORPHOLOGICAL RISK ASSESSMENT

1.1 General Approach to Morphological Risk Assessment

The *Guidelines for Incorporation of the Water Framework Directive into the Planning System*, WSIA at project level is undertaken using the familiar stages of screening, scoping, impact assessment and justification. Where WSIA scoping of a proposed development has determined that there may be potential for morphological deterioration in WFD water body status, a Morphological Risk Assessment must be undertaken in line with WFD and RBMP objectives. Morphological Risk Assessment is undertaken using a baseline morphological assessment for river reaches known as Morphological Quality Index for Ireland (MQI-Ireland). MQI-Ireland was developed by the Catchment Science and Management Unit of the EPA and is a measure of the current morphological condition of river water bodies in Ireland. Although MQI-Ireland forms a national dataset of current morphological condition, the tool has also been developed to be applicable at a scenario level. This MQI-Ireland tool is therefore used in Morphological Risk Assessment as a comparison of how morphology may deviate from current/baseline conditions as a result of a proposed development. Morphological Risk Assessment is an iterative process whereby the objective is to determine if there is a morphological risk and to ensure sufficient mitigation measures are put into place to ensure WFD and RBMP compliance.

In addition, the MQI-Ireland tool has been used to identify the presence or absence of barriers to river continuity for fish migration. Where a barrier to fish migration has been identified as a morphological pressure, contact should be made with Inland Fisheries Ireland (IFI) at the earliest possible stage to enable those concerned to comply with the provisions of the Fisheries Acts and Habitats Regulations. There is low risk for the relevant longitudinal connectivity indicator in the Reaches of the Skeoge River that are designated for arterial drainage maintenance.

1.2 Stages of Morphological Risk Assessment

The stages of Morphological Risk Assessment are described below and outlined in Figure 1.1:

- **Stage 1 Screening** – This stage is a qualitative assessment to screen for the presence or absence of morphological pressures that have the potential to directly or indirectly compromise compliance with WFD objectives. The correct identification of pressures requires consistent identification of the relevant targets, their size and the susceptibility to being impacted. Pressures that should be considered are listed in the Water Information System for Europe (WISE) which is included in Appendix A1. This screening stage should also consider if any phase(s) of the proposed development require further Morphological Risk Assessment i.e. construction, operation/maintenance, demolition phases and if independent Morphological Risk Assessment is required.
- **Stage 2 Scoping –** This stage considers how a development proposal could impact on morphology. The purpose of this stage is to quantify the extent of morphological risk by review of baseline water body MQI-Ireland Score and calculation of a scenario based MQI-Ireland Score, which is an assessment of the MQI-Ireland analysis taking into consideration the proposed development site, without any mitigation. If Acceptance Criteria is met, the application may proceed and no further assessment is required. If there remains a risk of non-compliance of WFD objectives, Stage 3 Detailed Assessment is required.
- **Stage 3 Detailed Assessment –** The purpose of this stage is to determine the risk to morphological condition of the proposed development with suitable mitigation measures put in place. This stage of Morphological Risk Assessment will take into consideration suitably chosen mitigation measures and is an iterative process whereby a mitigation measure or combination of mitigation measures can be assessed and amended iteratively to determine the most appropriate for the proposed development.
- **Stage 4 Decision –** The final stage of Morphological Risk Assessment is to determine whether or not the proposed mitigation measures reduce the potential morphological risk to an acceptable level. If determined acceptable, the outcome should be considered in line with wider WSIA of the proposed development. If the risk remains unacceptable, the application should be rejected or should proceed to a derogation under article 4.7 of the WFD or possibly the designation of the water body as heavily modified where there is an existing specified use, in this case flood management. The EPA are currently consulting on the designation of candidate HMWBs.

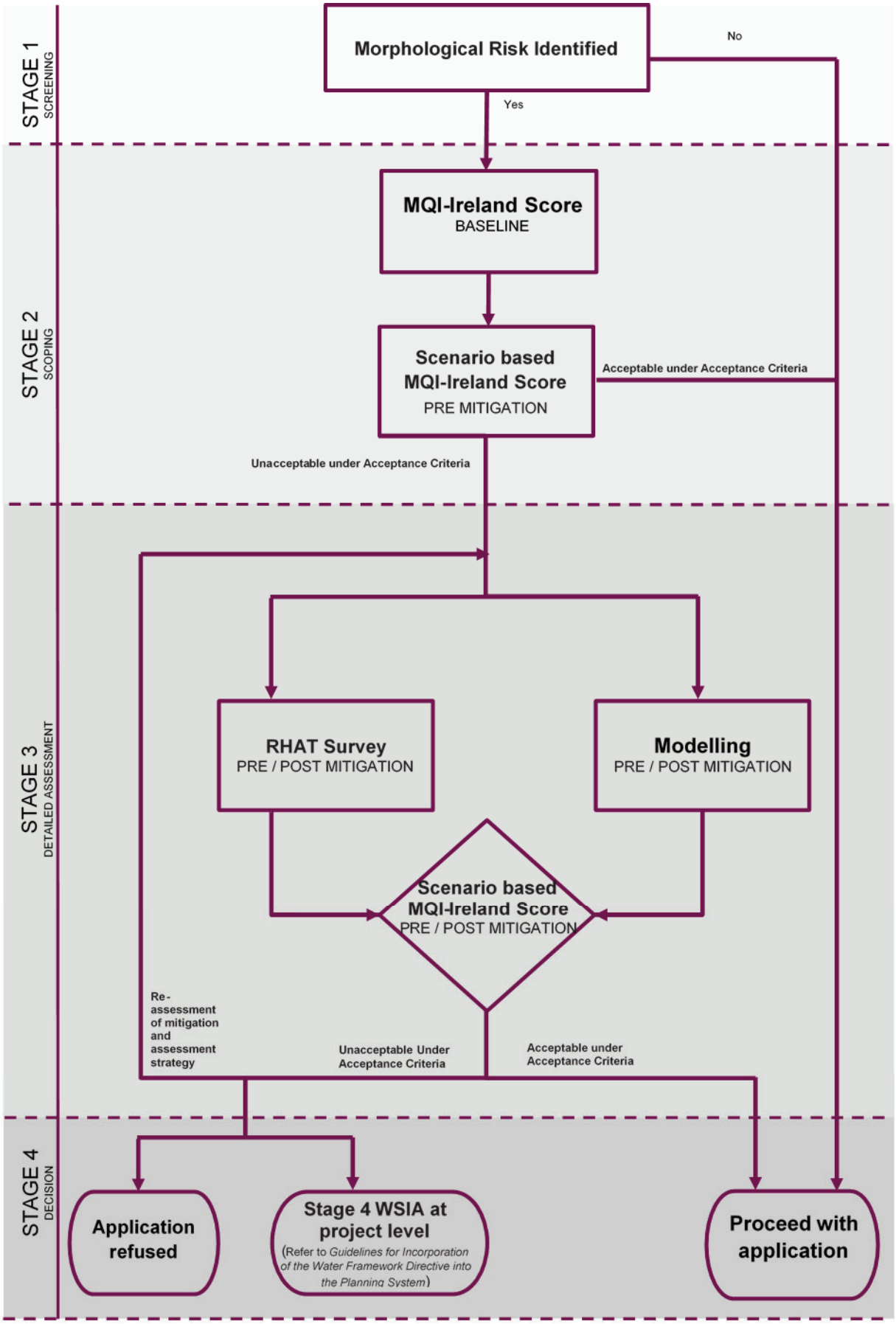

Figure 1.1: Approach to Morphological Risk Assessment

1.3 Description of Morphological Risk Assessment

1.3.1 Stage 1 Screening

Where overall WSIA has determined that a proposed development has the potential to impact on morphology, Morphological Risk Assessment is undertaken to determine whether a proposed development may result in non-compliance with WFD objectives in terms of morphology. This stage is a qualitative assessment to confirm the presence or absence of morphological pressures that have the potential to directly or indirectly compromise compliance with WFD objectives. In keeping with CIS Guidance Document No.3[4], driver, pressure, state, impact and response (DPSIR) framework has been used to understand the chain of causal links to determine if a risk assessment is required. The morphological pressure(s) relevant to the proposed development should be identified and should also consider the phase(s) (i.e., construction, operation/maintenance, demolition) which should be considered. Pressures that should be considered are listed in the Water Information System for Europe (WISE) which is included in Appendix A1.

If the planning authority is satisfied that there is no potential risk of non-compliance associated with the proposed development, following review of water bodies which may be affected within the catchment, and bearing in mind the precautionary approach, the process can end at Stage 1. However, where a potential morphological risk exists the assessment process will move onto Stage 2 to quantify the extent of potential morphological risk.

1.3.1 Stage 2 Scoping

Where Stage 1 Morphological Risk Assessment has identified a potential risk of non-compliance, a scoping exercise should be undertaken to determine the extent of morphological risk. This is undertaken using the Morphological Quality Index for Ireland (MQI-Ireland) tool which is a measure of the current morphological condition at reach scale of river water bodies in Ireland (further detail on MQI-Ireland is included in Section 2.1.1). This information can be requested from the EPA who operate and maintain the datasets for reaches of all Irish watercourses. The EPA have carried out extensive characterisation of Irish water bodies and a database has been setup to show morphological pressures which impact each water body on a national scale. This information is used as a baseline which is used for comparison against an MQI-Ireland assessment at the scenario level (further detail on scenario level assessment is included in Section 4.1.2). This scenario level assessment provides an updated score similar to the baseline MQI-Ireland score but which considers the potential morphological impacts associated with the proposed development at the relevant reach(es). At this stage, the scenario based assessment is undertaken in the absence of mitigation. It should be noted that a precautionary approach is required for all assessments.

An application may only pass this stage of Morphological Risk Assessment where it adheres to the Acceptance Criteria identified below. This Acceptance Criteria is relevant to the MQI-Ireland scoring system (see Table 2.1).

A proposed development will be accepted if, at Stage 2 scoping (pre-mitigation):

- There is no change in morphological condition band (i.e. from Good to Moderate) of any reach directly or indirectly impacted by the proposed development; and
- There is a decrease of ≤2%[5] of the baseline MQI score within the morphological condition band (with the exception of those with an existing MQI-Ireland score of less than good, within which zero deterioration is permitted) (N.B. any reduction in score should not preclude a waterbody from achieving high status); and
- The MQI score remains above the bottom quarter of the band (within which zero deterioration is permitted).

[4] CIS Guidance Doc. No. 3

[5] This is an arbitrary value which has been taken as a precautionary criteria to allow for screening of an acceptable number of assessments and may be refined through future studies.

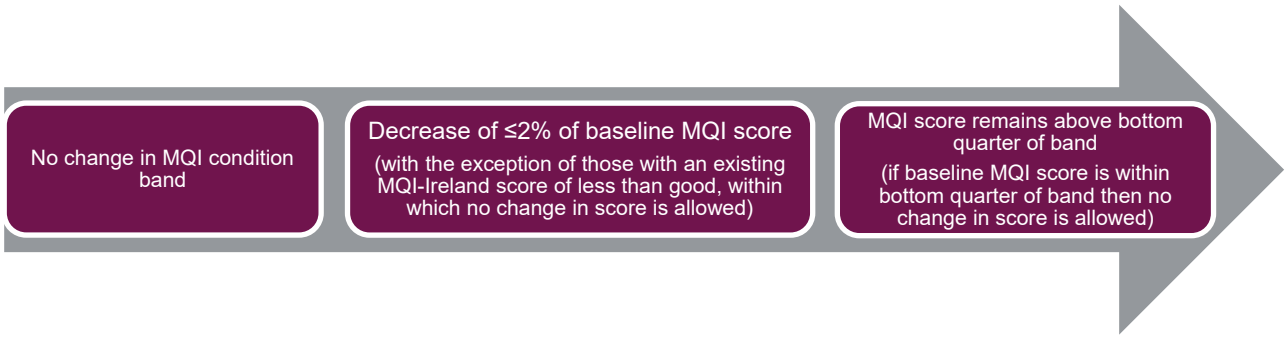

Figure 1.2: Stage 2 Acceptance Criteria

The above acceptance criteria are specific to MQI scoring at the reach level. Through adhering to this acceptance criteria would ensure a precautionary approach to negating any impacts at the waterbody level. Where the scenario based assessment has determined that there is no morphological risk of non-compliance with WFD objectives, the application may proceed, following General Binding Rules (GBR) to Stage 4, without the need for Stage 3 Detailed Assessment. However if Stage 2 Morphological Risk Assessment has determined that the deviation in MQI-Ireland score is unacceptable under the Acceptance Criteria, or there is uncertainty with regards to the extent of morphological risk, the assessment should move to a Stage 3 Detailed Assessment.

1.3.2 Stage 3 Detailed Assessment

Stage 3 Detailed Morphological Risk Assessment is undertaken to quantify the effectiveness of the proposed mitigation measure and ensure it is sufficient to negate any risk of non-compliance. This should be assessed and considered in sufficient detail to provide a quantitative appraisal of potential risk to morphological condition. This will typically involve site walkover using River Hydromorphology Assessment Technique (RHAT) (further detail on RHAT is included in Section 2.1.3) and possible use of a morphological model (i.e. hydraulic/sediment) (further detail on modelling is included in Section 2.1.4) of the river across a wide enough area to appreciate the catchment wide impacts and morphology processes involved. Given that MQI-Ireland, RHAT and modelling are undertaken at different spatial scales, these methods can be used complementary to each other to get a more detailed understanding of the risk to morphological condition.

The stage 3 assessment must be undertaken by a suitably qualified person (for example, a geomorphologist) that will identify whether hydromorphological modelling/RHAT or a combination of the two will be required, given the characteristics of the proposed development i.e. complex developments that are anticipated to have widespread or severe impacts will likely go straight into modelling and are unlikely to require RHAT, unless specific aspects need further assessment (e.g. RHAT spot checks). For the purposes of this pilot study a RHAT assessment only is proposed and detailed modelling is not undertaken.

Information from the RHAT and/or modelling are then used to refine the output of the scenario based MQI-Ireland score which considers the potential morphological impacts associated with the proposed development with relevant mitigation and management strategies included. Given that MQI-Ireland is a desk based tool that provides information on the current morphological condition at reach level, RHAT can also be used to confirm or refine these baseline conditions if deemed appropriate by the EPA. In this pilot study we have not used RHAT to alter the baseline conditions but rather to inform the likely improvement in the baseline conditions through the application of the Environmental Drainage Maintenance Guidance notes included in the OPW Environmental Guidance: Drainage Maintenance and Construction. This stage takes into consideration suitably chosen mitigation measures and is an iterative process whereby a mitigation measure or combination of mitigation measures can be assessed and amended iteratively to determine the most appropriate for the proposed development. The potential impact of the proposed development should be assessed and considered in sufficient detail to provide a quantitative appraisal of potential risk to water body status. There is a need to share data where relevant across other statutory assessments which may be undertaken as part of planning applications, most notably Appropriate Assessment and Environmental Impact Assessment.

An application may only pass this stage of Morphological Risk Assessment where it adheres to the Acceptance Criteria identified below. This Acceptance Criteria is relevant to the MQI-Ireland scoring system (see Table 2.1.1).

A proposed development will be accepted if at Stage 3 Detailed Assessment (post-mitigation):

- There is no change in morphological condition band (i.e. from Good to Moderate) of any reach directly or indirectly impacted by the proposed development; and
- There is a decrease in morphological risk score of ≤10%[6] within the morphological condition band (with the exception of those with an existing MQI-Ireland score of less than good, within which zero deterioration is allowed) (N.B. any reduction in score should not preclude a waterbody from achieving high status); and
- The MQI score remains above the bottom quarter of the band (within which zero deterioration is permitted).

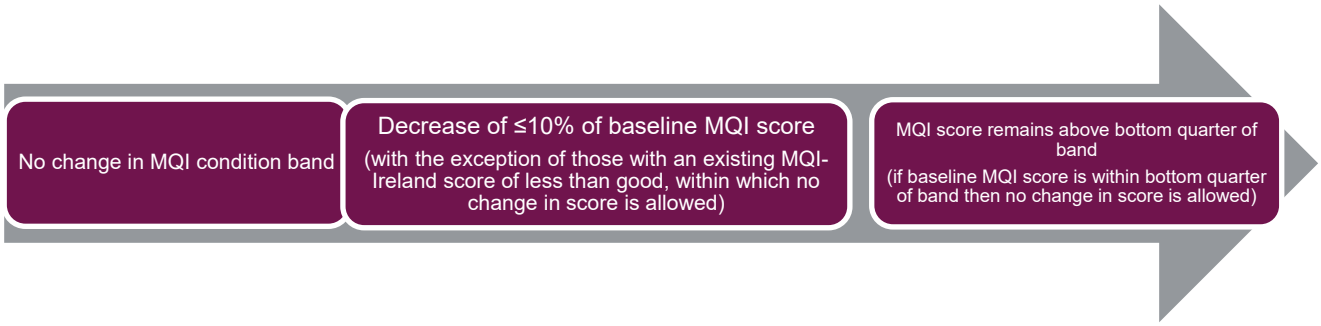

Figure 1.3: Stage 3 Acceptance Criteria

The above acceptance criteria are specific to MQI scoring at the reach level. Through adhering to this acceptance criteria would ensure a precautionary approach to negating any impacts at the waterbody level. Where no risk to morphological condition has been identified, following the Acceptance Criteria above, the process moves to Stage 4 Decision. Where there has been a change in the scenario based MQI-Ireland score, the EPA must be informed so that this information can be fed back into the baseline MQI-Ireland scores. Where a risk to morphological condition has been identified, mitigation and management strategies should be re-designed and included into the development proposal where/if appropriate and Stage 3 Detailed Assessment should be undertaken again. Where a morphological risk remains after all appropriate mitigation and management strategies have been included, following the Acceptance Criteria above, the application must be rejected or move to Stage 4 wider WSIA.

1.3.3 Stage 4 Decision

Where detailed assessment (modelling and/or RHAT) has determined that with mitigation measures in place, the proposed development poses no risk of non-compliance of the water body alone or in combination with other developments/pressures, the application may be accepted for Morphological Risk Assessment. The application will then be considered in terms of other elements scoped in during the WSIA at project level (Figure 2.1).

[6] This is an arbitrary value which has been taken as a precautionary criteria to allow for screening of an acceptable number of assessments and may be refined through future studies.

2 TOOLS USED IN MORPHOLOGICAL RISK ASSESSMENT

2.1.1 Morphological Quality Index for Ireland (MQI-Ireland)

MQI-Ireland is designed as a morphological condition assessment tool which has been developed and implemented nationally by the EPA Catchment Science and Management unit to provide an overview of the morphological condition of rivers. MQI-Ireland can be used as a decision support tool for the local planning authority/developers to assess the potential morphological risk from proposed developments in the Irish context. An MQI-Ireland score effectively describes how modified a water body is from its natural state. This natural state has been determined as the condition of the river water body as displayed on the OSI Cassini 6 inch mapping sheets. Assessment is undertaken at river reach level, i.e. a relatively homogenous portion of the river with a length in order of 1-10 km.

As part of the MQI-Ireland assessment, each water body has been broken down into river reaches and differentiated by:

- Landscape unit:
    - Flat to undulating
    - Undulating to hill
    - Hill to mountain

- Confinement:
    - Confined
    - Partly confined
    - Unconfined

- Channel pattern
    - Straight
    - sinuous
    - Meandering

Assessment is supported by attribute information such as significant pressures and a breakdown of the morphological indicator scores (categorised under longitudinal connectivity, lateral connectivity, channel morphology and riparian vegetation condition) contributing to the MQI-Ireland. To generate morphological condition indicators, identification of morphological features were required (e.g. weirs, bridges, bank protection, drainage schemes). This involved extracting spatial data from various sources such as OSi and OPW, in addition to using aerial imagery, ortho photography and historic maps as an aid to manually digitise such features. This national assessment data (MQI-Ireland scores) may be requested from the EPA.

It is a process-based method that assesses the morphological quality of a river based on three main elements:

- geomorphological functionality, which accounts for longitudinal and lateral continuity, riparian vegetation and planform pattern;
- degree of artificiality, which takes into consideration the presence of morphological alterations such as artificial reservoirs, bridges, embankments and sediment mining; and
- observed recent channel adjustments such as changes to the channel width or pattern.

The final MQI-Ireland score determines the resulting morphological condition of the relevant river reach. Morphological condition and contributing MQI-Ireland scores are provided in Table 2.1.1.

Table 2.1: Morphological Condition banding and MQI-Ireland Scores

Morphological Condition Bands	MQI-Ireland Score (%)
High	>80
Good	>60 - 80
Moderate	>40 - 60
Poor	>20 - 40
Bad	<20

The MQI-Ireland is designed to assess the overall current morphological conditions of a river reach (1-10km). Although changes in morphological condition over a small distance can be picked up by the MQI-Ireland tool, changes to the MQI-Ireland score will depend on scale and how significant these changes are within the total length. It is therefore determined that small scale changes (<1km) should be assessed using field based assessment methods such as the River Hydromorphology Assessment Technique (RHAT) in order to complement the MQI-Ireland score but also give an understanding of the scale and extent of impact.

2.1.2 MQI-Ireland at the scenario level

The MQI-Ireland is a tool for the evaluation and assessment of current baseline morphological condition (i.e. high, good, moderate, poor). The MQI-Ireland tool has been developed such that it can provide morphological condition assessment at the scenario scale. In this regard, MQI-Ireland can also be used to assess the potential impact on morphological condition of a proposed development at reach level.

For this purpose, an assessment should be undertaken making assumptions concerning the expected changes in some of the morphological indicators in response to the development. The comparison between assessments will indicate the tendency for change in MQI-Ireland score and thus morphological condition.

2.1.3 Field Based Assessment (RHAT)

Stage 3 Detailed Assessment identifies the predicted effectiveness of any proposed mitigation measure(s) and should be undertaken by a suitably qualified person. River Hydromorphology Assessment Technique (RHAT) may be used on the current water body state with a prediction on the impact of the pressure(s) from the proposed development (pre-mitigation) and also with a prediction on the impact inclusive of relevant mitigation measures (post-mitigation) to make an informed decision as to the effectiveness of the proposed mitigation. This information is then used to inform and refine the MQI-Ireland score with the relevant mitigation included. RHAT classifies river morphology based on a departure from naturalness, and assigns a morphological score directly related to that of the WFD. The eight criteria that are scored are:

1. Channel morphology and flow types - Considers the channel pattern expected for the river type; the presence/absence of geomorphic units expected for the river type; presence of man-made interventions that may impact channel pattern and geomorphic units.
2. Channel vegetation - Considers the presence of in-channel vegetation and wood expected for the river type; presence of in-channel vegetation management.
3. Substrate diversity and condition - Considers bed sediment size as expected for the river type; presence of alteration to bed sediment structure (e.g. sedimentation, armouring).
4. Barriers to continuity - Considers longitudinal connectivity for water, sediment, and fish; presence of barriers; presence of channel modification (e.g. widening) that will impact upstream/downstream connectivity due to water supply.
5. Bank structure and stability - Considers the shape and stability of the bank; presence of bank modification due to man-made interventions; presence of hard engineering structures on the bank; presence of poaching.

6. Bank and bank top vegetation - Considers the presence of vegetation along the bank as expected for the river type; extent of vegetation along the bank; type of vegetation; variety of vegetation types; presence of vegetation management; presence of alien species.
7. Riparian land cover - Considers the land cover type adjacent to the river (20m from bank); presence of human activities.
8. Floodplain interaction - Considers the degree of lateral connectivity between river and floodplain; presence of bank modification due to man-made interventions.

RHAT is used to assign scores which are grouped into five categories: High; Good; Moderate; Poor; and Bad. The standard RHAT survey is carried at 500m, but the technique is used to assess a range of site scale lengths from 50m where appropriate. The use of RHAT is dependent on the degree of impact. It is imperative that RHAT assessment is undertaken by a suitably qualified person who may decide on the most appropriate scale of assessment and if/where spot checks are required.

Table 2.2: Morphological Condition banding and associated RHAT scores.

Morphological Condition Band	RHAT Score
High	>0.8
Good	>0.6 - 0.8
Moderate	>0.4 - 0.6
Poor	>0.2 - 0.4
Bad	<0.2

RHAT plays a vital role in identifying why a water body might be at risk of deterioration of morphological condition, deciding what indirect and direct measures are needed to improve status and in helping to prevent further deterioration. RHAT surveyors should be suitably qualified to ensure assessment is undertaken correctly and at an appropriate scale, relative to the development and/or water body. As part of the North South Shared Aquatic Resource (NS SHARE) project, the Environment Protection Agency (EPA) of the Republic of Ireland and the Northern Ireland Environment Agency (NIEA) developed a training manual[7] for those undertaking RHATs. To achieve consistent results surveyor training is essential to ensure accuracy and consistency in recording features. It is therefore advised that those undertaking RHAT surveys should read and adhere to this manual prior to assessment.

2.1.4 Morphological Modelling

Stage 3 detailed morphological modelling can be undertaken solely or in combination with a RHAT (full or spot checks) on the relevant water body/water bodies to determine the effectiveness of proposed mitigation measures. A range of models can be utilised to review the current morphological condition of the river, review how a proposed development may alter the morphological condition and assess how effective mitigation measures may be in reducing morphological impacts. Further information on the types of morphological models that may be used based on the scale of assessment and the site characteristics can be found on the REstoring rivers FOR effective catchment Management (REFORM) web-based knowledge and information system[8]. In addition, example case studies whereby a range of different models have been used under various scenarios are provided by the River Restoration Centre[9].

[7] RHAT training manual

[8] REFORM web-based knowledge and information system

[9] River Restoration Centre

A morphological model attempts to model flow depth and velocities across a river channel using computer algorithms based on physical equations describing flow dynamics.

Information which may be required to develop a model include:

- Detailed information of channel bed and floodplain topography;
- An assessment of the bed, banks and floodplain roughness (as indicated by vegetation, substrate etc.);
- Water depths and velocity profiles for different discharges for calibration.
- Additional depth and velocity data for validating (i.e. testing) the model.
- Records of past rainfall, discharge and flooding may also be collated for calibrating and testing the model further.

Morphological models should:

- Be constructed by a suitably qualified professional (i.e. hydrologist/geomorphologist);
- Be constructed 1D, 2D or 3D (based on related pressures)
- Make use of appropriate software
- Be constructed using appropriate data;
- Be constructed to an appropriate resolution;
- Be constructed to an appropriate scale (consider distance downstream as well as at site location);
- Be calibrated and validated;
- Simulate an appropriate time period, assessing short term and long term impacts.

Once a baseline model for the existing river has been constructed, calibrated and validated, it can then be modified to represent the proposed development and tested with various mitigation measures or combinations. Modelling may be an iterative process allowing mitigation measures to be optimised by reviewing outputs and assessing which measures are most effective. The information gained from the modelling is then used to inform and refine the MQI-Ireland score with the relevant mitigation included.

3 APPLICATION OF THE MORPHOLOGICAL RISK ASSESSMENT FOR DRAINAGE MAINTENANCE IN THE SKEOGE RIVER

<table>
<tr><th colspan="3">Assessment Process</th></tr>
<tr><td>Stage 1 - Screening</td><td colspan="2">Water Information System for Europe (WISE) – Pressure 4.1.4 Physical alteration of channel/bed/riparian area/shore – Other

Activity Screened In

Summary of screening in line with CIS Guidance Document No.3[10], driver, pressure, state, impact and response (DPSIR) framework
<table>
<tr><th colspan="2">Scenario 1 – Introduction of Drainage Scheme</th></tr>
<tr><td>Driver
an anthropogenic activity that may have an environmental effect (e.g. agriculture, industry)</td><td>• Flood Protection</td></tr>
<tr><td>Pressure
the direct effect of the driver (for example, an effect that causes a change in flow or a change in the water chemistry)</td><td>• Hard defences
• Culvert improvements
• Bridge replacement</td></tr>
<tr><td>State
the condition of the water body resulting from both natural and anthropogenic factors (i.e. physical, chemical and biological characteristics)</td><td>• Physical alteration of the channel bed and banks
• Alteration of riparian habitat</td></tr>
<tr><td>Impact
the environmental effect of the pressure (e.g. fish killed, ecosystem modified)</td><td>• Change of morphological supporting conditions
• Prevention of acheivement of the Environmental Objectives of water bodies affected</td></tr>
<tr><td>Response
the measures taken to improve the state of the water body (e.g. restricting abstraction, limiting point source discharges, developing best practice guidance for agriculture)</td><td>• Reconnection of the flood plain
• Monitor water quality, flow and sediment regime
• Application of mitigation through the implemntation of the Construction Environmental management Plan.</td></tr>
</table></td></tr>
</table>

[10] CIS Guidance Doc. No. 3

Stage 2 - Scoping	*MQI Assessment (no mitigation)*					
Skeoge_010	**MQI reach code (Reach ID)**		39_FU_UC_Str_121		39_FU_UC_Str_123	
	Waterbody		Skeoge_010		Skeoge_010	
	Pre-/Post-works		**Baseline**	**Post works**	**Baseline**	**Post works**
	Version (Impact Category: Low / Medium / High)		V1.08.01	V1.08.01	V1.08.01	V1.08.01
	Coordinates (start of reach)		7°24'19.929"W 55°3'33.916"N	7°24'19.929"W 55°3'33.916"N	7°24'21.364"W 55°2'57.894"N	7°24'21.364"W 55°2'57.894"N
	Reach length (m)		2163.14	2163.14	1846.2	1846.2
	Weighting group		Standard	Standard	Standard	Standard
	Longitudinal Connectivity: F1	Longitudinal continuity in sediment and wood flux				
	Longitudinal Connectivity: A1m	Upstream alteration of flows (relevant effects on channel morphology)				
	Longitudinal Connectivity: A2	Upstream alteration of sediment discharges				
	Longitudinal Connectivity: A4	Alteration of sediment discharge in the reach				
	Lateral Connectivity: F3	River-corridor connectivity				Improvement - Removal of arterial drainage embankment along RHB for one third of the reach length will result in an improvement in the lateral connectivity
	Lateral Connectivity: F5	Presence of a potentially erodible corridor				Improvement - Removal of arterial drainage embankment along RHB for one third of the reach length will result in an improvement in the lateral connectivity
	Lateral Connectivity: A6	Bank protection				
	Lateral Connectivity: A7	Artificial embankments		No Change - Removal of arterial drainage embankment along LHB will result in an improvement in the lateral connectivity along this reach, however the inclusion of additional flood walls/embankments downstream of the bridge will offset this benefit. However the Skeoge_010 is a candidate HMWB with the specified use of arterial drainage therefore the expectation is to achieve good ecological potential. The removal of the embankments downstream and reconnection with the floodplain would be one of the mitigation measures which would improve the hydromorphological supporting conditions along this reach		Improvement - Removal of arterial drainage embankment along RHB for one third of the reach length will result in an improvement in the lateral connectivity
	Channel morphology: F7	Planform pattern and cross section variability				
	Channel morphology: A8	Artificial changes of the river course				
	Channel morphology: A13	Historic modification (within cut/reclaimed peat)				
	Channel morphology: CA1	Adjustments in channel pattern				
	Channel morphology: CA2	Adjustments in channel width				
	Riparian condition: F12	Width of functional riparian vegetation (absence)				
	Riparian condition: F13	Linear extent of functional riparian vegetation (absence)				
	MAI (alteration index)		63.63%	63.63%	65.52%	60.52%
	MQI score		36.37%	36.37%	34.48%	39.48%
	MQI class		Poor	Poor	Poor	Poor
	Percentage change			**0.00%**		**0.00%**
	Hydromorphological quality class change			Remains within MQI class		Remains within MQI class

Stage 2 – Scoping

Burnfoot_020

MQI Assessment with and without Mitigation

MQI reach code (Reach ID)		39_FU_PC_Sin_118		39_FU_UC_Str_120	
Waterbody		Burnfoot_020 (Carnashannagh Stream)		Burnfoot_020	
Pre-/Post-works		**Baseline**	**Post works**	**Baseline**	**Post works**
Details		Original MQI output		Original MQI output	
Version		V1.08.01	V1.08.01	V1.08.01	V1.08.01
Coordinates (start of reach)					
Reach length (m)		491.86	821.29	801.15	801.15
Weighting group		Standard	Standard	Standard	Standard
Longitudinal Connectivity: F1	*Longitudinal continuity in sediment and wood flux*		Improvement from High impact to medium impact with improvement in culverts and removal of barrier to fish migration		
Longitudinal Connectivity: A1m (Excluded from score)	*Upstream alteration of flows (relevant effects on channel morphology)*				
Longitudinal Connectivity: A2 (Excluded from score)	*Upstream alteration of sediment discharges*				
Longitudinal Connectivity: A4	*Alteration of sediment discharge in the reach*		Improvement from High impact to medium impact with improvement in culverts and removal of barrier to fish migration at bottom culvert		No Change - Urban area ext change removal of bridge in downstream is likely to impr dynamics in this reach
Lateral Connectivity: F3	*River-corridor connectivity*				No Change in the River corri connectivity, the proposed d on the same alignment as th embankments and boundary
Lateral Connectivity: F5	*Presence of a potentially erodible corridor*				No Change, the proposed de the same alignment as the e embankments and boundary
Lateral Connectivity: A6	*Bank protection*				
Lateral Connectivity: A7	*Artificial embankments*				No change, new embankme the alignment of the current embankments. Flood walls boundary walls of the prope protected in Los Na Griene F
Channel morphology: F7	*Planform pattern and cross section variability*				
Channel morphology: A8	*Artificial changes of the river course*				
Channel morphology: A13	*Historic modification (within cut/reclaimed peat)*				
Channel morphology: CA1	*Adjustments in channel pattern*				
Channel morphology: CA2	*Adjustments in channel width*				
Riparian condition: F12	*Width of functional riparian vegetation (absence)*				No Change - the riparian zon changed significantly as a re inclusion of the embankmen walls in this reach as the def same alignment of existing e and boundary walls.
Riparian condition: F13	*Linear extent of functional riparian vegetation (absence)*				
MAI (alteration index)		37.91%	30.00%	32.22%	32.22%
MQI score		62.09%	70.00%	67.78%	67.78%
MQI class		GOOD	GOOD	GOOD	GOOD
Percentage change			8%		0
Hydromorphological quality class change			No		No

In terms of the acceptance criteria which must be satisfied in order for a scheme to proceed, as outlined in the Morphological Risk Assessment guidance, the drainage scheme has been assessed as follows

	• **There is no change in morphological condition band of any reach directly or indirectly impacted by the proposed development;** *There is an improvement in the morphological condition of the Skeoge River (39_FU_UC_Str_123) as a result of FRS however overall there will be no change in the morphological condition of the reaches within or downstream of the FRS extents.* • **There is a decrease in morphological risk score of ≤10%[11] within the morphological condition band (with the exception of those with an existing MQI-Ireland score of less than good, within which zero deterioration is allowed)** (N.B. any reduction in score should not preclude a waterbody from achieving high status); - *No deterioration in MQI.* • **The MQI score remains above the bottom quarter of the band (within which zero deterioration is permitted).** *The current MQI score in the Carnashannagh Stream is within the bottom quarter of the good hydromorphological quality band however the FRS will result in an improvement in the MQI that takes the score into the 3rd quarter of the condition band.*
Stage 3 Detailed Assessment	***Not required Scoping demonstrates there will be no risk to Morphological Supporting conditions***
Stage 4 Decision	***Proceed with the Flood Relief Scheme***

[11] This is an arbitrary value which has been taken as a precautionary criteria to allow for screening of an acceptable number of assessments and may be refined through future studies.

APPENDIX A1 MORPHOLOGICAL PRESSURES[12]

WISE Pressure	Main Driver(s)	Description
4.1.1 - Physical alteration of channel/bed/riparian area/shore	Flood protection	Refers largely to longitudinal alterations to water bodies.
4.1.2 - Physical alteration of channel/bed/riparian area/shore - Agriculture	Agriculture	Refers largely to longitudinal alterations to water bodies. Includes land drainage to enable agricultural activities.
4.1.3 - Physical alteration of channel/bed/riparian area/shore - Navigation	Transport	Refers largely to longitudinal alterations to water bodies.
4.1.4 - Physical alteration of channel/bed/riparian area/shore – Other		Refers largely to longitudinal alterations to water bodies.
4.1.5 - Physical alteration of channel/bed/riparian area/shore – Unknown or obsolete		In case the driver for the physical modification is unknown.
4.2.1 - Dams, barriers and locks - Hydropower	Energy – hydropower	
4.2.2 - Dams, barriers and locks - Flood protection	Flood protection	
4.2.3 - Dams, barriers and locks - Drinking water	Urban development	
4.2.4 - Dams, barriers and locks - Irrigation	Agriculture	
4.2.5 - Dams, barriers and locks - Recreation	Tourism and recreation	Small dams are used in rivers to create recreational areas (bathing waters) and also angling areas
4.2.6 - Dams, barriers and locks - Industry	Industry, Energy - non-hydropower	Dams are sometimes created to provide freshwater for large industry e.g. typically for cooling purposes
4.2.7 - Dams, barriers and locks - Navigation	Transport	
4.2.8 - Dams, barriers and locks – Other		
4.2.9 - Dams, barriers and locks – Unknown or obsolete		
4.3.1 - Hydrological alteration – Agriculture	Agriculture	A change in the flow regime (e.g. due to land drainage).
4.3.2 - Hydrological alteration – Transport	Transport	A change in the flow regime - typically due to inland navigation
4.3.3 - Hydrological alteration – Hydropower	Energy – hydropower	A change in the flow regime (e.g. hydropeaking)
4.3.4 - Hydrological alteration – Public water supply	Urban development	A change in the flow regime
4.3.5 - Hydrological alteration - Aquaculture	Fisheries and aquaculture	A change in the flow regime
4.3.6 - Hydrological alteration – Other		

[12] WISE-WFD database

WISE Pressure	Main Driver(s)	Description
4.4 - Hydromorphological alteration - Physical loss of whole or part of the water body	Flood protection, Climate change	Dry river beds etc.
4.5 - Hydromorphological alteration - Other		Other hydromorphological alterations not included in any of the categories above, including alteration of water level or volume for purposes not identified above.