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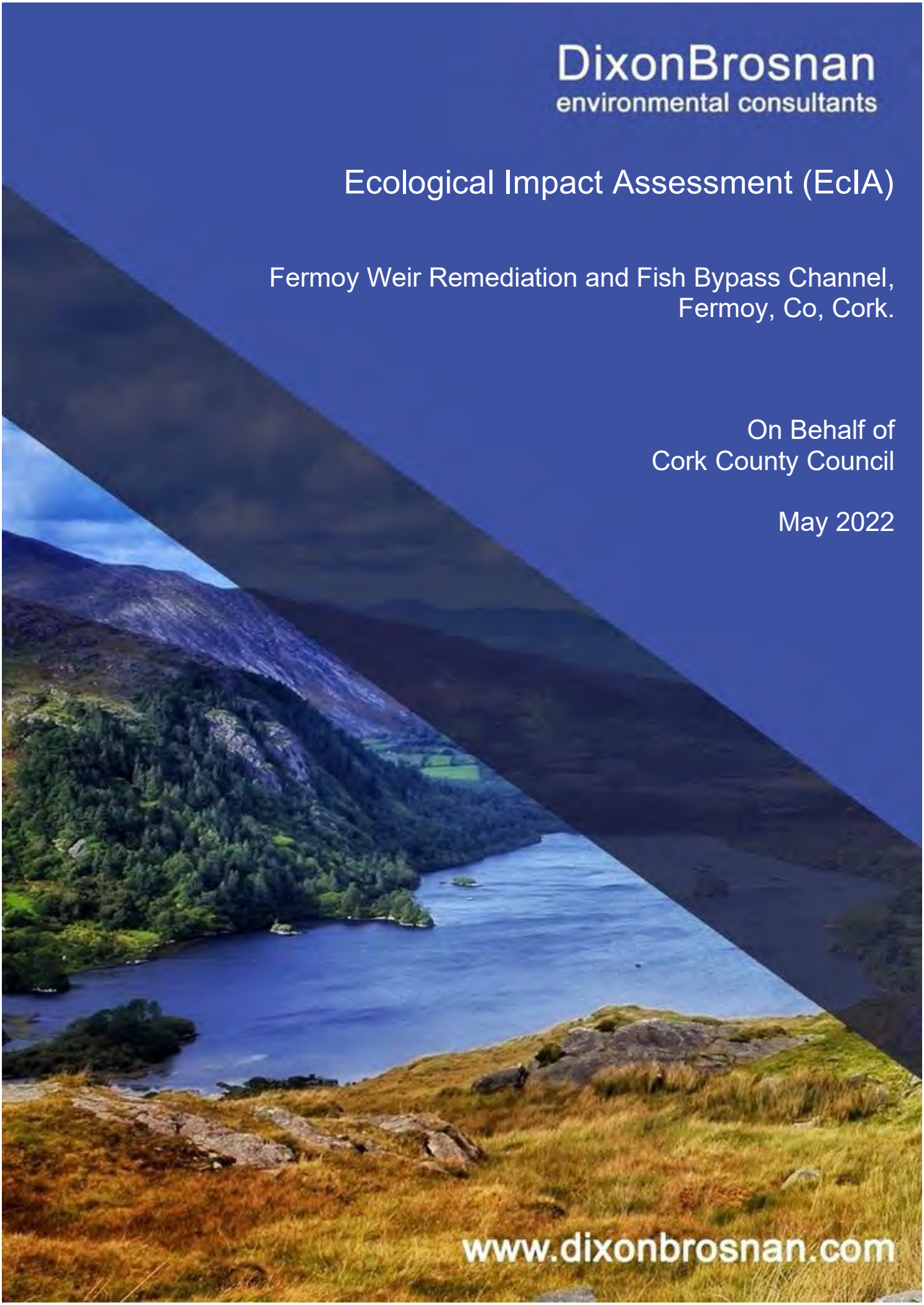
Ecological Impact Assessment (EcIA)

Fermoy Weir Remediation and Fish Bypass Channel,
Fermoy, Co, Cork.

On Behalf of
Cork County Council

May 2022



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Project	**Ecological Impact Assessment (EclA) Fermoy Weir Remediation and Fish Bypass Channel, Fermoy, Co. Cork**	
Client	Cork County Council	
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Date	**Revision**	**Prepared By**
29/11/21	1st Draft	Sorcha Sheehy BSc PhD
10/12/21	2nd Draft	Carl Dixon BSc MSc
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1. Introduction

DixonBrosnan Environmental Consultants were commissioned by Cork County Council (CCC) to assess the potential ecological impacts of the proposed Fermoy Weir Remediation and Fish Bypass Channel, Fermoy, Co. Cork. This report describes and evaluates the habitats with their representative flora and fauna and addresses the potential impacts of the development on the ecology of the site and the surrounding area.

2. Methodology

2.1 Introduction

This appraisal is based on surveys of the proposed works area and a review of desktop data. Although not part of an Environmental Impact Assessment Report (EIAR) this report follows the structure and protocols detailed in Advice notes for preparing Environmental Impact Statements (EPA Draft, 2015) and Draft Guidelines on the Information to *be Contained in Environmental Impact Assessment Reports'* (EPA 2017) and *Guidelines on the information to be contained in Environmental Impact Assessment Reports* (EPA 2022).

2.2 Desktop Review

A desktop study was carried out identify features of ecological value occurring within the proposed development site and those occurring in close proximity to it. A desktop review also allows the key ecological issues to be identified early in the appraisal process and facilitates the planning of surveys. A sensitive species data request for terrestrial and aquatic flora and fauna covering the 10km grid squares adjoining the proposed works area (i.e., W79 & W89) revealed records for a number of protected (freshwater) aquatic species in the vicinity of the proposed development site, as did data from the National Biodiversity Data Centre (NBDC).

Sources of information used for this report include the following:

- National Parks & Wildlife Service (NPWS) - www.npws.ie
- Environmental Protection Agency (EPA) – www.epa.ie
- National Biodiversity Data Centre (NDBC)– www.biodiversityireland.ie
- *County Cork Biodiversity Action Plan 2009-2014*
- NPWS (2012) *Blackwater River (Cork/Waterford) SAC (site code 2170) Conservation objectives supporting document -coastal habitats*
- NPWS (2012) *River Blackwater (Cork/Waterford) SAC (site code 2170) Conservation objectives supporting document- woodland habitats*
- King J. J. and Linnane S. M. (2004) *The status and distribution of lamprey and shad in the Slaney and Munster Blackwater SACs. Irish Wildlife Manuals, No. 14.* National Parks and Wildlife Service, Department of Environment, Heritage and Local Government, Dublin, Ireland and

- NS 2 (2010) *Freshwater Pearl Mussel. Second Draft. Munster Blackwater Sub-basin management plan.*
- Sweeney, N. and Sweeney, P. (2017) *Expansion of the White-clawed Crayfish (Austropotamobius pallipes (Lereboullet)) population in the Munster Blackwater. Irish Naturalists'* Journal 35: 94-98.
- DixonBrosnan (2020). *Natura Impact Statement (NIS) Emergency Maintenance Works Fermoy, Co. Cork*
- Sweeney (2012). *Ecological Assessment of Likely Significant Impacts of Proposed Repairs to the Fermoy Weir Fish Pass*
- Sweeney (2014). *Likely Significant Impacts of a Proposed Fish Bypass Channel at Fermoy Weir – Screening Statement and NIS,*
- Sweeney (2017). *Ecological Assessment of Likely Significant Impacts of Proposed Rehabilitation Works to the Fermoy Weir.*
- *Fermoy flood relief scheme – additional bat and Otter surveys 2007* (DixonBrosnan 2007)
- *Flood Relief Scheme Fermoy, Co. Cork* (Punch & Partners, 2005)
- Bat Conservation Ireland – http://www.batconservationireland.org
- Birdwatch Ireland - http://www.birdwatchireland.ie/
- Amber Barrier Atlas - https://amber.international/european-barrier-atlas/
- Invasive Species Ireland - http://www.invasivespeciesireland.com/
- *Best Practice Guidance for Habitat Survey and Mapping* (Heritage Council, 2011)
- *Guidelines for Assessment of Ecological Impacts of National Road Schemes* (National Roads Authority, 2009)
- *Environmental Impact Assessment of Projects Guidance on the preparation of the Environmental Impact Assessment Report (Directive 2011/92/EU as amended by 2014/52/EU)* European Union, 2017
- *Assessment of plans & projects in relation to N2K sites – Methodological Guidance* (EC 2021).
- *Guidance document on the strict protection of animal species of Community interest under the Habitats Directive* (EC 2021) and
- *Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessmen*t (DoHLGH 2018).

The appraisal of impacts follows the protocols outlined in guidelines for Assessment of Ecological Impacts of National Road Schemes (National Roads Authority, 2009), CIEEM

(2016) *Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal, 2nd edition* and CIEEM *Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine* (2018).

2.2.1 Relevant Legislation

Flora and fauna in Ireland are protected at a national level by the Wildlife Acts, 1976 to 2000 and the European Communities (Birds and Natural Habitats) Regulations 2011. They are also protected at a European level by the EU Habitats Directive (92/43/EEC) and the EU Birds Directive (79/409/EEC) amended in 2009 as the Directive 2009/147/EC.

Under this legislation, sites of nature conservation importance are then designated in order to legally protect faunal and floral species and important/vulnerable habitats.

The categories of designation are as follows:

- Special Areas of Conservation (SAC) are designated under the European Communities (Birds and Natural Habitats) Regulations 2011 to comply with the EU Habitats Directive (92/43/EEC);
- Special Protection Areas (SPAs) and designated under the EU Birds Directive (79/409/EEC) amended in 2009 as the Directive 2009/147/EC; and
- Proposed Natural Heritage Areas (pNHA) are listed under the Wildlife (Amendment) Act, 2000. They have limited legal protection under Local Authority Development Plans.

2.3 Survey Overview

Site surveys were carried out on the 26th May 2020, 29th May 2020, 8th June 2020, 9th July 2020, 26th July 2020, 28th May 2021, 30th May 2021, 19th of July 2021 and 31st July 2021. Additional detail on survey methodologies, dates and results are included in **Appendix 2,** *Aquatic baseline report for Fermoy Weir, Fermoy, Co. Cork*, **Appendix 3.** *A Survey of Freshwater Pearl Mussel (Margaritifera margaritifera) at Fermoy Bridge on the Munster Blackwater River, Co. Cork and* **Appendix 4.** *Tree survey and Arboricultural Impact Assessment*.

The following surveys were carried out as part of this assessment.

- Terrestrial habitat assessment was carried out by DixonBrosnan Environmental Consultants on the 28th May 2021, 30th May 2021, 19th of July 2021 and 31st July 2021. Habitats were classified according to the classification scheme outlined in the Heritage Council publication *A Guide to Habitats in Ireland* (Fossitt, 2000) and following the guidelines contained in *Best Practice Guidance for Habitat Survey and Mapping* (Heritage Council, 2011). Surveys for birds and mammals were carried out in conjunction with habitat surveys.

- Aquatic habitat assessment was conducted by Triturus Environmental Ltd in May, June and July 2020 utilising elements of the methodology given in the Environment Agency's *River Habitat Survey in Britain and Ireland Field Survey Guidance Manual 2003* (EA, 2003) and the Heritage Council's *A Guide to Habitats in Ireland* (Fossitt, 2000);

- Aerial fixed-wing drone survey was undertaken of the wider Fermoy Weir site by Triturus Environmental Ltd in June 2020 to further inform the walkover surveys and ensure the most contemporary mapping data was available for aquatic baseline surveys;

- Macrophyte survey was undertaken by Triturus Environmental Ltd in May, June and July 2020 to establish the presence of the Annex I habitats at the proposed development site;

- Biological water quality (Q-sampling) was undertaken by Triturus Environmental Ltd at n=4 sites (two upstream and two downstream of Fermoy Weir) as per Toner *et al.* (2005) in May, June and July 2020;

- SONAR survey was undertaken by Triturus Environmental Ltd in July 2020 to determine the bathymetry and substrata-type (i.e. bottom hardness and rugosity) within the survey sections of channel;

- Tree survey and arboricultural impact assessment was carried out by Mark Donnelly BSc in July 2021 within the proposed development site following the standards in BS 5837 (2012);

- Alluvial woodland assessment was carried out Mark Donnelly BSc in 15th September 2021;

- Otter *Lutra lutra* survey was undertaken by Triturus Environmental Ltd 250m upstream and 250m downstream of Fermoy Weir in May, June and July 2020 as per methodology developed by Macklin *et al.* (2019);

- Bat surveys were carried out by DixonBrosnan Environmental Consultants on the 30th May 2021 and 23rd of September 2021 utilising guidelines set out in '*Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd ed)'* (Collins, 2016);

- Electro-fishing survey was carried out (under permission from Inland Fisheries Ireland (IFI)) in July 2020. Electro-fishing methodology followed accepted European standards (CEN, 2003) and adhered to best practice (e.g. CFB, 2008);

- Environmental DNA (eDNA) analysis was undertaken on water samples (collected May 2020) by Triturus Environmental Ltd to assess the distribution of Twaite Shad *Alosa fallax* within the Blackwater River (Cork/Waterford) SAC (002170);

- White-clawed Crayfish *Austropotamobius pallipes* surveys were undertaken in May 2020 by Triturus Environmental Ltd under a National Parks and Wildlife (NPWS) open licence (no. C79/2020), in accordance with Reynolds *et al.* (2010);

- Freshwater Pearl Mussel *Margaritifera margaritifera* survey of the River Blackwater was carried out by Sweeny Consultancy in May 2020 100m upstream and 100m downstream of Fermoy Bridge (Kent Bridge) in accordance with the Stage 1 & 2 guidelines given in Irish Wildlife Manual No. 12, NPWS (Anon., 2004) and

- Invasive species surveys were carried out by DixonBrosnan Environmental Consultants on the 28th May 2021, 30th May 2021, 19th of July 2021 and 31st July 2021.

2.4 Report contributors

This report was prepared by Carl Dixon MSc (Ecological Monitoring) and Dr. Sorcha Sheehy PhD (Ecology/ornithology). Fieldwork was conducted by Carl Dixon MSc (Ecological Monitoring), Mark Donnelly BSc (Forestry), Ross Macklin BSc (Applied Ecology), Pascal Sweeny BSc (Zoology), Cian Gill MSc (Ecological Monitoring).

Carl Dixon MSc (Ecology) is a senior ecologist who has over 20 years' experience in ecological and water quality assessments. Carl Dixon holds an Honours Degree (BSc) in Ecology and a Masters (MSc) in Ecological Monitoring from UCC. He is a senior ecologist who has over 25 years' experience in ecological assessment. Prior to setting up DixonBrosnan Environmental Consultants in 2000, Carl set up and ran Core Environmental Services which included Rural Environmental Protection Scheme (REPS) planning for landowners and ecological assessments. Carl has particular experience in freshwater ecology including electrofishing fish stock assessments and water quality assessments. He also has considerable experience in habitat mapping and mammal ecology including survey work and reporting in relation to badgers and bats. Other competencies include surveys for invasive species and bird surveys. Carl has extensive experience with regards to EIAR and NIS mitigation and impact assessment. He has particular experience in large-scale industrial developments with extensive experience in complex assessments as part of multi-disciplinary teams. Such projects include gas pipelines, incinerators, electrical cable routes, oil refineries and quarries.

Dr. Sorcha Sheehy PhD (ecology/ornithology) is an experienced ecological consultant specialising in bird behaviour. Sorcha received a BSc in Applied Ecology from UCC and subsequently went on to receive a PhD in behavioural ornithology at UCC. During her PhD research, Sorcha studied bird-aircraft collision with a particular focus on bird behaviour, included field-based behavioural observations at airports, bird cadaver examination and collision classification and the use of radar tracking to model collision risk. Sorcha has worked for over 12 years in a professional ecology role and specialises in the coordination of ecology projects and assessments. She has coordinated and contributed to Habitats Directive Assessments (AA screenings and NIS) and Environmental Impact Assessment Reports (EIAR) for a range of small and large-scale projects with particular expertise in assessing impacts on birds. Notable projects include Arklow Bank Wind Park, Shannon Technology and Energy Park and Waste to Energy Facility, Ringaskiddy.

Ross Macklin BSc (Hons) Applied Ecology HDip GIS Dip IPM MCIEEM IFM. Ross is an environmental scientist specialising in freshwater and fisheries ecology. He studied a BSc in Applied Ecology at UCC and later completed a higher diploma in Geographical Information Systems and Integrated Pest Management. He is currently completing his PhD in UCC. in the area of fisheries ecology. Ross has an in-depth knowledge of all freshwater ecosystems and riparian corridors. He has undertaken river habitat, lake habitat, wetland habitat and fisheries assessments in professional work for 16 years. His specialist freshwater experience lies in biological and physiochemical water quality analysis, fisheries ecology, riparian habitat assessments, habitat mapping, protected species, geographical information systems, ecological design and invasive species. Ross has expert experience in identifying and assessing macrophyte plant, aquatic bryophtes, fish and macro-invertebrates from a variety of aquatic habitats. He routinely undertakes Habitat Regulations Assessments, Fisheries Assessments, Protected Species Surveys, Invasive Species Surveys, Habitat & Surface Water Management Plans, CEMP, EcIA and EIAR reporting.

Pascal Sweeney of Sweeney Consultancy is a freshwater biologist, specialising in aquatic invertebrates. Following his B.Sc. degree in zoology, he was employed by UCD as a Research Assistant to monitor biological parameters in the Killarney Lakes. This led to a research MSc on nutrient enrichment impacts on lake invertebrates. He is currently the Honorary Secretary of the Irish Freshwater Sciences Association. His current work is focused mainly on biological water quality assessments (Q-value; SSRS) and protected species surveys. Every summer from 2012 to 2021, he has been engaged by EPA for the River Monitoring Programme. He has also carried out a large number of other water quality surveys for Irish Water, Inland Fisheries Ireland, Coillte, local authorities (Wexford, Kilkenny, Carlow, Kildare Waterford, Tipperary and Offaly Co. Cos.), and industries (e.g. Glanbia, Dairygold, Irish Sugar, Irish Distillers, Lisheen Mine, Carbury Mushrooms). Pascal has conducted Freshwater Pearl Mussel surveys in the catchments of the Slaney, Barrow, Nore, Suir, Munster Blackwater, Lee, Roury, Kerry Blackwater, Roughty, Flesk, Finnihy, Behy, Owennafeanna, Creagh, Colligan, Tay, Clady and Corrib. White-clawed Crayfish surveys conducted in the catchments of the Liffey, Barrow, Nore, Suir, Munster Blackwater, Lee and Shannon.

Mark Donnelly (Forestry) holds a BSc. Hons in Forestry from Bangor University, Wales, and is a member of the Institute of Chartered Foresters. He worked as an arboricultural consultant for the National Trust in Wales for 22 years and was a lecturer in Forest Ecology at Bangor University. In Ireland, he has completed landscape assessments for a range of projects including wind farms, quarries, local authorities, housing developments, roads and pipelines.

Cian Gill MSc (Ecology) is a qualified ecologist with ten years' experience working with wildlife and ecology-based NGOs and public bodies in Ireland, the UK and the US. Past projects include invasive species planning for the city of Rosemount, Minnesota, and the Under The Sea project for Essex Wildlife Trust. Recent projects include ecological reports for Cork-based housing and private developments.

3. Receiving Environment

3.1 Existing Site and Project Background

The proposed development is located in the vicinity of Fermoy Bridge on the River Blackwater in the town of Fermoy, Co Cork. Fermoy weir extends from the northern bank of the river on the west side of the bridge, through the second arch from the south bank and continues east of the bridge towards a tie in with the apex of Mill Island. Due to the age and the poor condition of the Mill Race Weir wall, an initial breach of the weir which occurred around 2016 has led to progressive unravelling of the masonry Mill Race weir wall and erosion of the western end of Mill Island. The OPW undertook emergency riverbed stabilisation works in the autumn of 2020 to mitigate against the excessive scour that was occurring as a result of the high velocities through the breach. The current speed of the waters flowing through the breach in the weir is too fast to facilitate upstream movement of migratory fish and is unable to meet the requirements of IFI in terms of providing fish passage for fish of all species.

Cork County Council (CCC) is obliged to protect the weir against further deterioration. Despite the presence of a fish ladder in the weir, and the existing breach, the weir acts as a barrier to the passage of certain fish species The project requires a solution that will enable CCC to fulfil their obligations to maintain and repair the weir (as its owner) at Fermoy, a Protected Structure under Section IV of the Planning & Development Act 2000 and comply with the conservation

and fisheries obligations to provide for the free passage of fish within the River Blackwater arising under the Water Framework Directive, Habitats Directive and Inland Fisheries Act 2010 and related legislation.

In order to comply with the above legislative requirements, it is proposed to construct a new fish bypass channel on the northern bank of the river on the western side of Fermoy Bridge. A detailed discussion on the options for the fish bypass channel and weir remediation is included in the Natura Impact Statement (NIS).

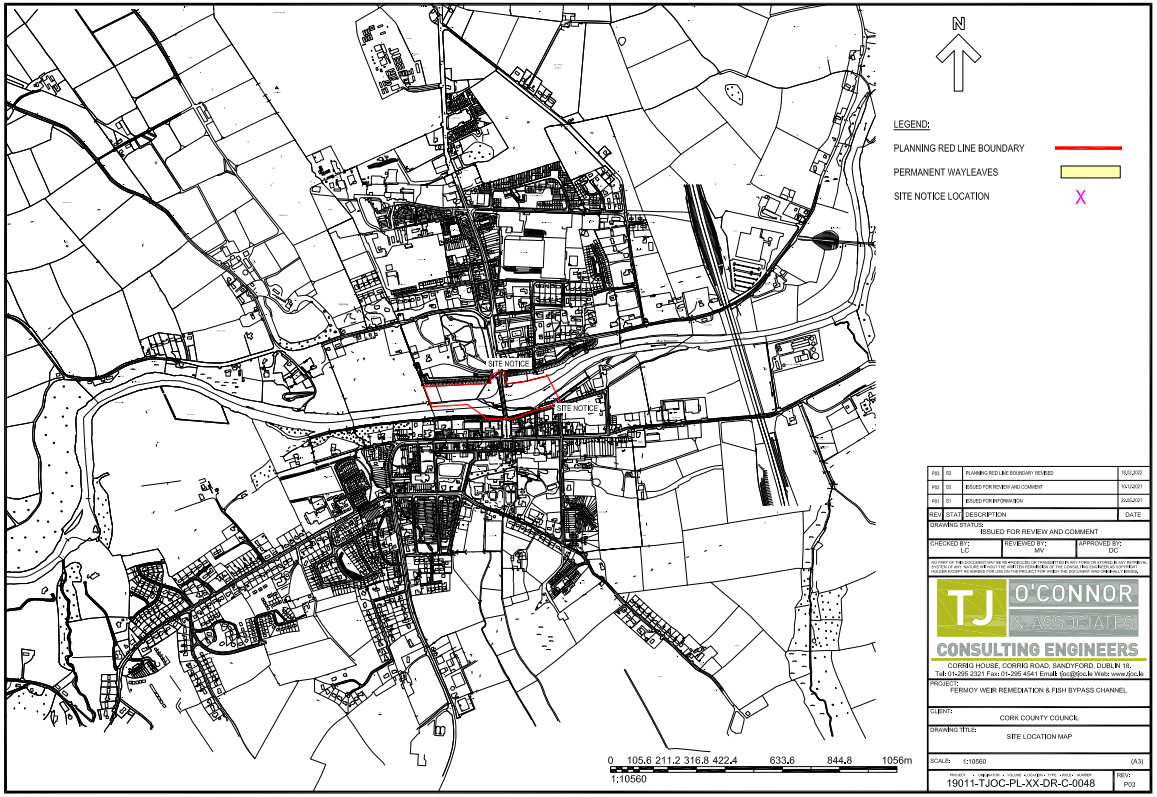

Figure 1. Site location | Source TJ O'Connor

3.2 Proposed Development

3.2.1 Overview of proposed development

The proposed project comprises the remediation of the existing weir, including reconstruction of breached sections of the weir, and the construction of a rough channel pool bypass to provide for fish passage around the weir. Further detail on the channel design and construction works are included in **Appendix 6** *Drawings*.

The weir remediation works can be divided into two different elements which comprise the remediation of the section of the weir, upstream of Fermoy Bridge, including the existing fish ladder incorporated in the weir, and the section of the weir downstream of the bridge. The weir is categorised as a rubble embankment (or Crump) type weir upstream of the bridge and extending for a distance of 37m east of Fermoy Bridge. The remaining section of the weir, extending eastwards, is a gravity wall type weir (referred to as the Mill Race weir wall section). It is this section of the weir that has been breached in the approx. locations as shown on the Existing Site Layout Plan drawing 19011-TJOC-PL-XX-DR-C-0051 included in the planning drawings and reproduced at **Appendix 6**.

The locations of the different sections of the weir are indicated on Drawing No. 19011-TJOC-PL-XX-DR-C-0058 in **Appendix 6.** A section of the gravity wall type weir has collapsed resulting in a breach in the weir.

The locations of cross-section through the existing weir, as well as proposed remedial works to each of these sections, are shown on drawings 19011-TJOC-PL-XX-DR-C-0059 and 19011-TJOC-PL-XX-DR-C-0060 (**Appendix 6**) and are described below. Proposed remedial details to the existing fish pass are included on Drawing No. 19011-TJOC-PL-XX-DR-C-0081 (See **Appendix 6**).

3.2.2 Weir remediation - Embankment Section

The remediation of the embankment (crump) section of the weir will involve the removal of the existing concrete apron and resetting of the limestone setts with the addition of random rubble fill (similar to the existing) where required. A high tensile geotextile will be incorporated to assist in reducing wash out of the fill in the embankment. At both the upstream heel and downstream toe of the crump weir section, the undercut / missing stonework will be reset on concrete heel and toe footings along with the addition of rock armour on both the upstream and downstream sides to prevent undercurrents undermining the embankment, in particular on the downstream section in the future.

The crest of the crump weir will be reinstated to a level corresponding to the historic level of the weir as evident from the historic photographs of the weir. A level of 21.45mOD is proposed for this section on the remediated weir.

Cross-sections through the embankment section of the weir, showing the proposed remediation works, are shown at Drawing No.'s 19011-TJOC-PL-XX-DR-C-0061 and 19011-TJOC-PL-XX-DR-C-0062 included in the planning drawings and reproduced at **Appendix 6**.

3.2.3 Weir Remediation – Mill Race Weir Wall

The remediation of the Mill Race section of the weir, east of the Bridge, will involve reconstructing the breached sections with existing and new stonework to closely resemble Fermoy Weir Remediation and Fish Bypass Channel Outline Construction Management Plan the existing masonry. Given the nature of this section of the weir, it is proposed to inject natural cement (also referred to as Prompt) into the fill sections and place mass concrete in the core of the new section of the weir. The stonework facing will then be pointed in natural cement and the downstream face of the weir protected by adding rock armour. The capping of the Mill Race wall will be removed, the wall raised and the capping reset to a remediated level of 21.55mOD.

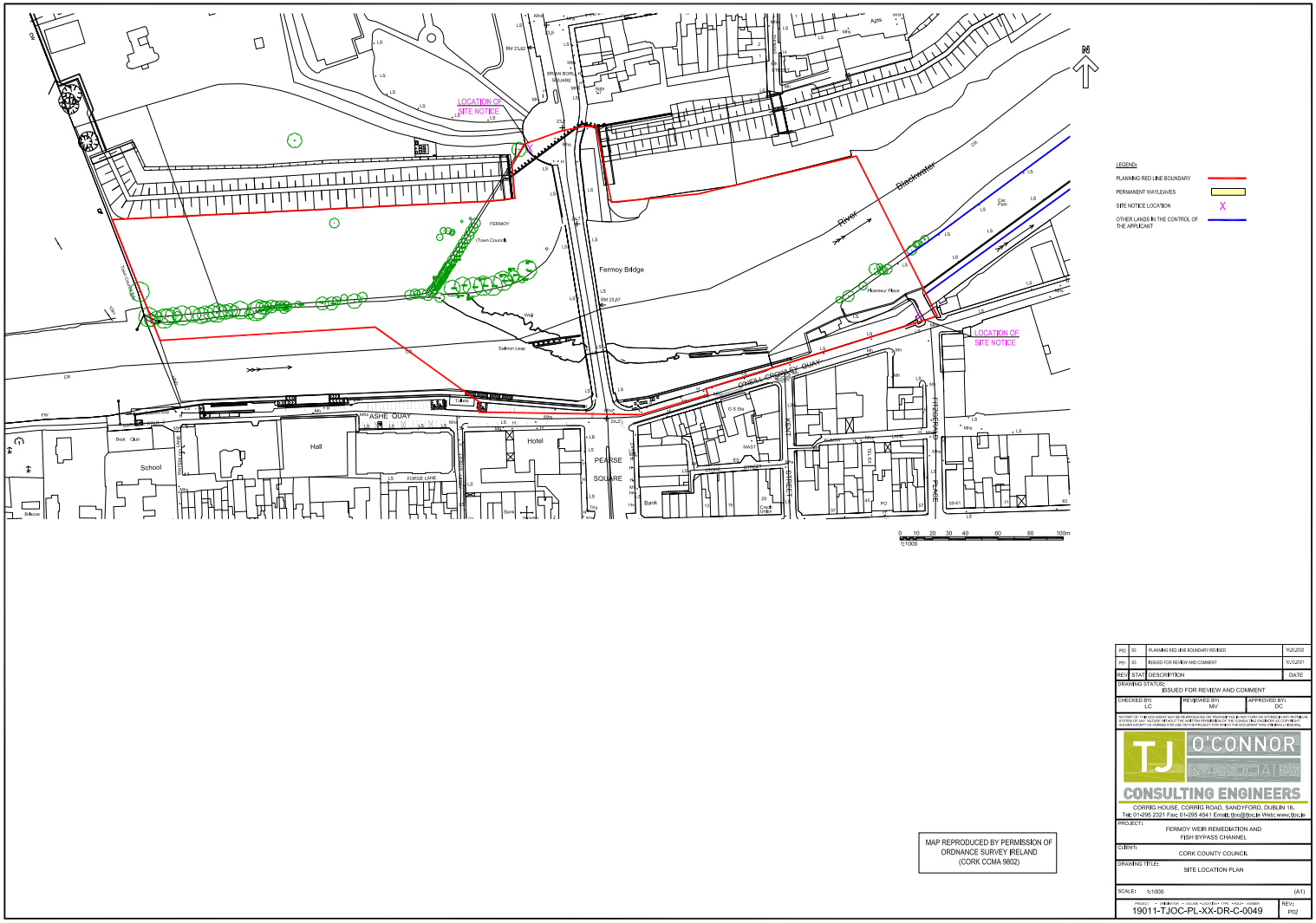

Figure 2. Proposed development site boundary | Source TJ O'Connor

3.2.4 Proposed Fish Bypass

The proposed bypass consists of constructing a curved rock (rough channel pool) ramp type of bypass on the northern bank of the river Blackwater, west of Fermoy Bridge. The rock ramp will provide a ladder for fish migrating upstream and resting pools will be created by the varying levels of rock weir walls.

The Bypass Channel will have sheet piled masonry faced side walls, The bed of the channel will comprise a gravel bed on rockfill. Armourstone, pitched vertically, will create the intermediate pools (12 No in total) and steps in the bypass channel.

The construction of the Bypass channel will require the removal of a number of riverbank trees. Planting of willow into the embankment of the fish pass will screen views of the development. A riparian enhancement planting scheme and wildflower meadow is proposed for the riverbank area to the north of the fish pass site (See Doyle O'Troithigh Landscape Plan LP-01-PP which is included in **Appendix 6**).

A drawing of the proposed fish bypass channel is presented on Drawing No. 19011-TJOC-PL-XX-DR-C-0053 (See **Appendix 6**).

3.2.5 Principal Characteristics

The principal characteristics of the proposed development are as follows:

Bypass Channel

- Felling of approximately 30 No trees for Bypass channel and demolition (by lowering) of approximately 110m of existing masonry river wall (detail on tree for removal is included in Drawing No. 19011-TJOC-PL-XX-DR-C-0083 **(See Appendix 6).**
- Excavation of ~14,500m^3 of spoil for construction of Bypass;
- Installation of ~2,050m^2 of sheet piles and ~250m length of concrete capping beams for side walls of Bypass Channel;
- Construction of ~250m^2 of masonry facing to bypass channel walls;
- Placement of ~3,750m^3 of Gravel and rockfill for base of bypass channel;
- Placement of ~95m^3 of Armourstone pitched vertically to create steps/ intermediate weirs in the Bypass channel;
- Installation of ~70m^3 of concrete and ~500m^2 of sheet piles for inlet weir wall to bypass channel;
- Profiling and landscaping ~175m^2 of banks with 1:2 to 1:4 side slopes with landscaping as per Landscape Architect's proposals;
- Restoration of existing Salmon leap including replacement of damaged and missing limestone from side walls and base;

- Riverbed profiling between outlet from Fish Bypass Channel and Fermoy Bridge ~425m^3.

Weir Remediation

- Demolition of ~176m^3 of concrete apron on face of embankment;
- Placement of ~2,800m^2 of geotextile fabric and resetting of 2,800m^2 of limestone sets;
- Excavation of ~315m length of trenches in river bed for toe and heel protection to embankment;
- Placement of ~395m^3 of concrete in toe and heel trenches;
- Placement of ~833m^3 of rock armour to toe and heel of embankment;
- Construction of ~95m^3 of concrete core for reconstructed Mill Race wall where the wall has been breached
- Removal of capping stone from existing Mill Race Wall
- Natural cement injection to both faces existing masonry weir wall (91.2m^2);
- Grout injection of ~92m^2 of masonry in existing Mill Race Weir wall;
- Pointing of ~260m^2 of Masonry in existing Mill Race Weir wall
- Raising of ~15m of existing weir wall with masonry and *in situ* concrete.
- Reinstatement of capping stones to Weir wall at adjusted level.

All ancillary works including tree felling, temporary diversion and control of flows, tie into existing structures and riverbanks, provision of access causeways and haul routes, disposal of surplus material, silt control measures and ecological monitoring.

3.3 Construction Methodology

The construction of the project will involve conventional construction methodologies and so will require the use of typical construction plant and vehicles. The anticipated phasing of construction will generally be as follows.

3.3.1 Site setup

- Establish site hoarding, signage on north bank of river:
- Establish site offices, welfare facilities and construction deliveries set-down area adjacent the site as shown at Drawing 19011-TJOC- PL-XX-DR-C-0085 (see **Figure 3)**.
- The main compound will be located on the north bank of the Blackwater and a satellite compound will be located in the council carpark at Mill Island.

- All site accommodation and welfare facilities at the main compound will be located above the 1% AEP flood level at this location, based on the OPW's flood maps of the area.

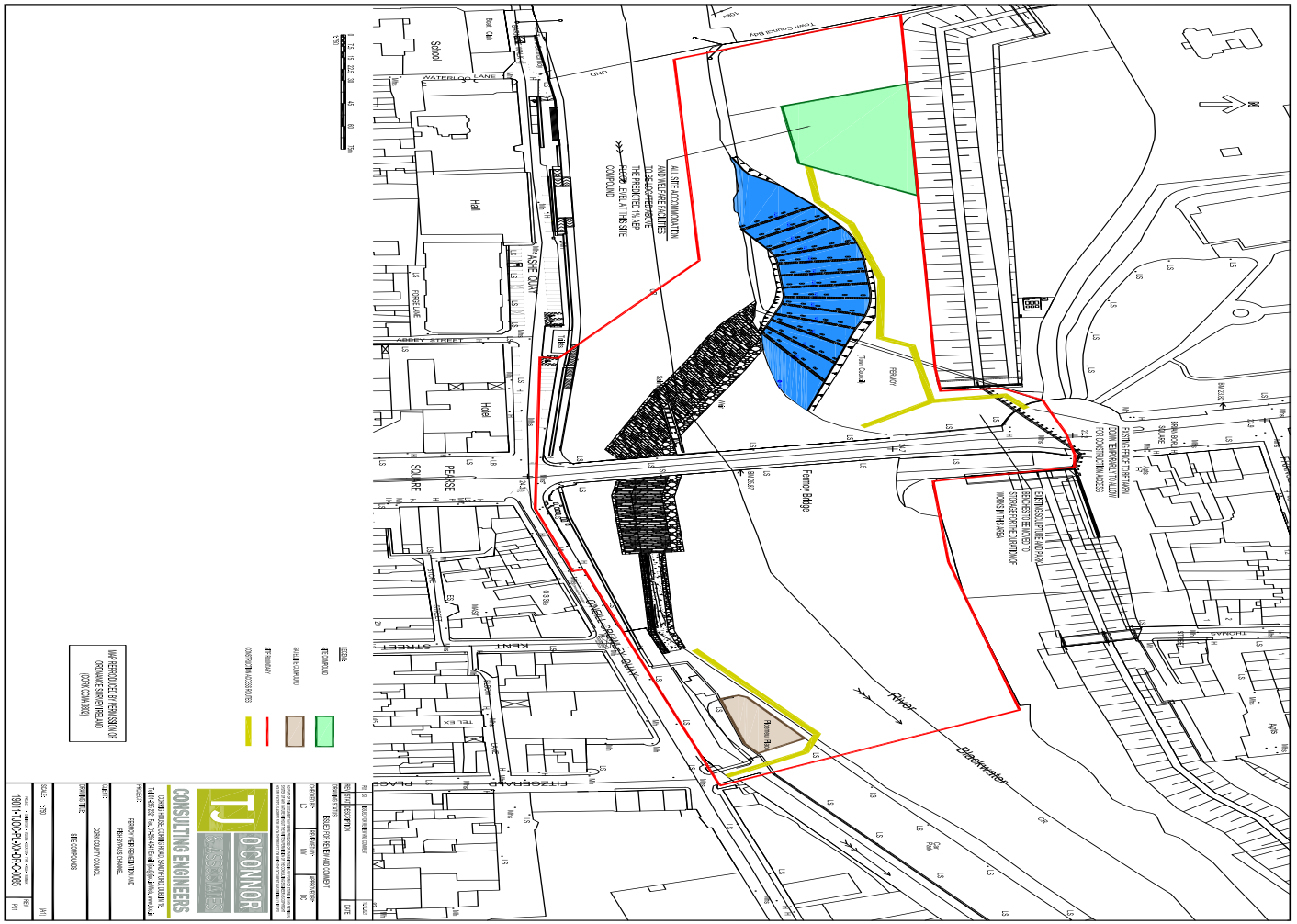

Figure 3. Site setup identifying site compound and satellite compound | Source T.J. O'CONNOR & ASSOCIATES

3.3.2 Construction Work Sequence

Construction Works Sequence

The anticipated sequence of construction works will entail:

1. The remediation of the weir upstream (west) of Fermoy Bridge initially;

2. Followed by (or possibly concurrent with) the construction of the fish bypass channel on the north bank of the river.

3. On completion of the bypass channel works, flow from the river will be directed through the bypass channel, at which stage to flow to the Mill Race will be dammed at the southernmost arches of Fermoy Bridge facilitation the remediation and reinstatement of the weir downstream (east) of the bridge.

These stages are shown at Drawing 19011-TJOC- PL-XX-DR-C-0086 (See **Figure 4**). Construction works during Stages 1 and 2 will be accessed and serviced from the compound at the north side of the river. Works for Stage 3 will be accessed and serviced from a satellite compound at the Mill Island carpark.

Figure 4. Phasing of instream works | Source T.J. O'CONNOR & ASSOCIATES

Stage 1

There are constraints in respect of when in-stream works can be carried out within the river Blackwater in accordance with the "Guidelines on the Protection of Fisheries during Construction Works in or Adjacent to Waters", IFI,2016.

The construction methods used within the River Blackwater will take into account the preservation of stream flows for movement of fish by ensuring that a minimum depth of water shall be maintained within the river.

A temporary sheet piled dam will be erected upstream of the works to facilitate the weir remediation works, comprising removal of the existing concrete apron, the excavation of the trench for placement of the new toe protection material and to allow the placement of geotextile fabric and resetting of limestone setts to the embankment section of the weir.

Downstream of the embankment section of the weir, a trench will be excavated for the placement of heel protection materials and, in order to undertake this excavation, a bund will be placed in the riverbed to divert the flow away from the area of works. The location of the upstream sheet piled dam and the downstream bund, on either side of the weir, will be located so as to accommodate access routes alongside the embankment.

Bed levels between the end of the bypass channel and the northernmost arches of Fermoy Bridge will be excavated to the levels proposed for the project.

The existing salmon leap will be reinstated and infilled.

Stage 2

Depending on the contractor's programme, in parallel with or following on from Stage 1 activities, the contractor will undertake the following activities for the construction of the Fish Bypass channel.

The bypass channel will be constructed offline without the excavated channel being extended into the river channel until the majority of the bypass works are completed. Therefore, the upstream and down steam ends of the bypass channel will be closed off with temporary sheet piles which will be cut back or extracted when the flow is to be directed into the bypass channel.

The activities required for this stage will include:

- Tree felling;
- Topsoil stripping, stockpiling and disposal of excess;
- Sheet piling for side walls and temporary end walls;
- Bulk excavation, stockpiling of gravels for re use and off-site disposal of excess materials associated;
- Concrete placement for walls and capping beams;
- Construction of masonry faced walls

- Placement of rock fill to bed of channel
- Placement of armourstone and perturbation stones
- Placement of gravels
- Profiling of banks, topsoiling and landscaping;
- Removal of temporary end walls and diversion of flow into channel

Stage 3

Stage 3 construction activities cannot commence until the fish bypass channel is completed in Stage 2 and flows are diverted from the river Blackwater to the Bypass channel. The activities required for this stage will include:

- Erection of temporary dam across southernmost arches of Fermoy Bridge to stop flow to ECoW Channel;
- Provision of construction access from Mill Island carpark;
- Erection of temporary bund downstream of ECoW weir wall;
- Excavation and filling of toe and heel protection trenches alongside embankment section weir;
- Placement of geotextile layer and limestone setts for surface of embankment section of weir;
- Removal of capping stone from Weir wall:
- Recovery of stonework from collapsed sections of weir wall:
- Natural cement and grout injection to both faces existing masonry weir:
- Construction of concrete core for replacement section of weir wall:
- Masonry facing to replacement sections of weir wall and pointing of masonry to remaining sections of weir wall
- Raising of sections of weir wall to uniform level and placement/replacement of capping stones to ECoW weir wall
- Dressing of rock armour at Mill Island to reinstated weir wall and associated profiling of river bed;
- Removal of access and associated bund;
- Removal of temporary dam upstream of bridge;
- Removal of site compounds and demobilisation.

The listed sequence of works is indicative only. In practice, the actual approach taken by the Contractor will be subject to a range of factors, including the following;

Conditions of planning;

- Contractors proposed works methodology;
- Weather;
- Seasonal constraints;
- Ecological constraints (crayfish relocation, fish relocation, turbidity monitoring, etc.)
- Resources;
- Subcontractors;
- Lead in times.

Options for methods of construction will be further explored with the contractor appointed to undertake the work prior to commencement on site.

3.4 Landscape Plan

A proposed landscape plan has been included with this planning application. This includes areas grass meadow and hard wearing ryegrass areas, locally sourced willow and an areas of native species riparian enhancements along the boundary of the fish bypass channel including the following:

- 15% Alder - 8-10 cms Trees / 80-100cms Transplants
- 15% Salix 8-10 cms Trees / 80-100cms Transplants
- 10% Wild Cherry 8-10cms Trees / 80-100cms Transplants
- 10% Bird Cherry 8.10cms Trees / 80-100cms Transplants
- 10% Native Black Poplar 80-100cms Transplants.
- 15% Holly 40-60Cms Transplants
- 15% Blackthorn 90-120 Cms Transplants
- 2.5% Bramble - 40-60cms Transplants
- 2.5% Hazel - 60-90Cms Transplants
- 2.5% Dog Rose - 60-90Cms Transplants
- 2.5% Spindle - 90-120 Cms Transplants

Tree planting will also include a mixture of native species are proposed including Alder, Willow, Scots Pine, Birch & Rowan - 12-14cms. See Doyle O'Troithigh Landscape Plan LP-01-PP which is included in **Appendix 6** and reproduced at **Figure 5** below.

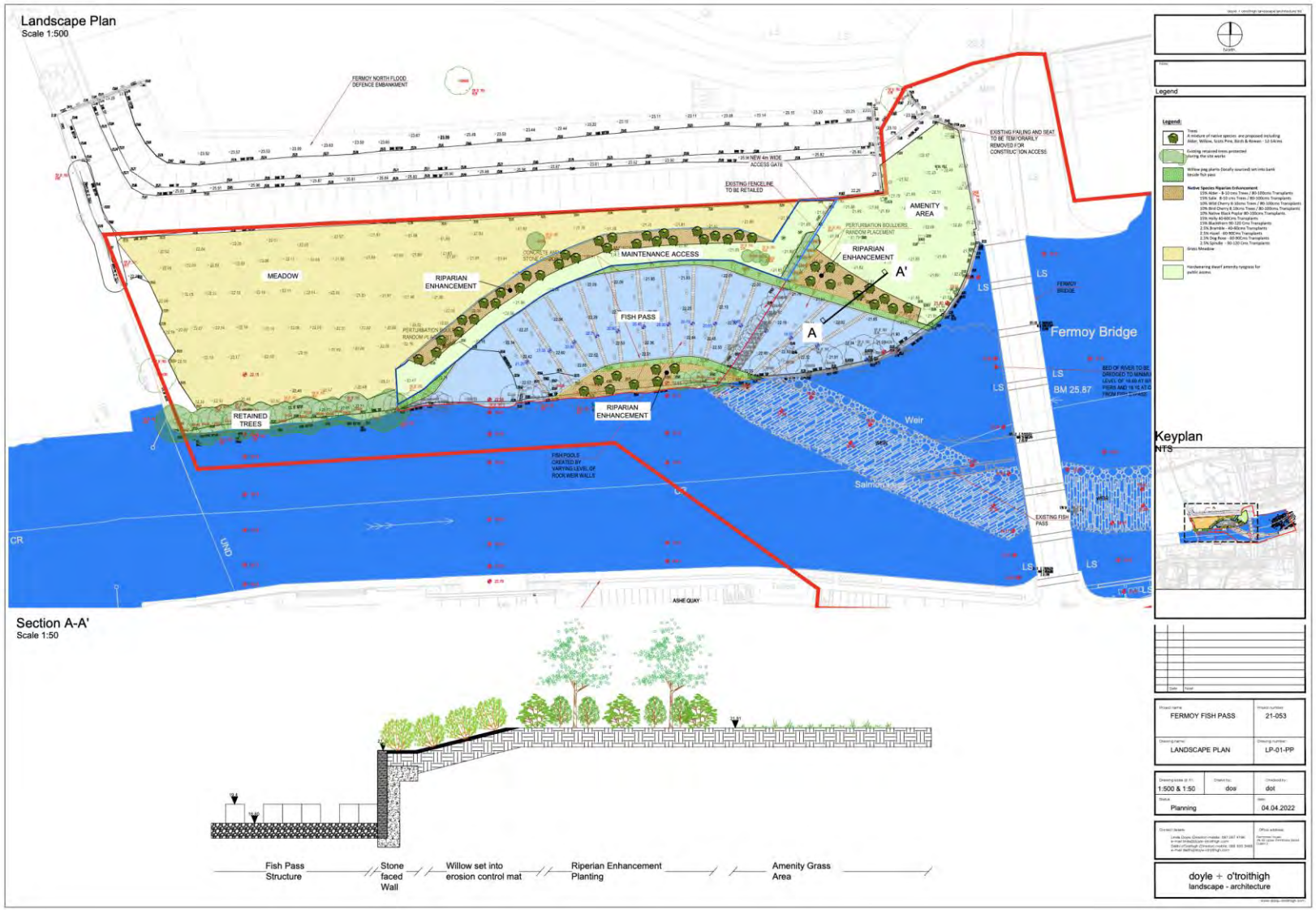

Figure 5. Landscape plan | Source Doyle & O'Troithigh

4. Designated Conservation Areas

Special Areas of Conservation (SACs) and candidate SACs are protected under the Habitats Directive 92/43/EEC and the European Communities (Birds and Natural Habitats) Regulations 2011, as amended. Special Protection Areas (SPAs) are protected under the Birds Directive 2009/147/EC and European Communities (Birds and Natural Habitats) Regulations 2011, as amended. Collectively, these sites are referred to as Natura 2000 sites or European sites. Natural Heritage Areas and proposed Natural Heritage Areas (NHAs/pNHAs) are national designations under the Wildlife Act 1976, as amended. A NHA/pNHA is designated for its wildlife value and receives statutory protection. A list of pNHAs was published on a non-statutory basis in 1995, but these have not since been statutorily proposed or designated. Consultation with the NPWS is still required if any development is likely to impact on a pNHA.

The proposed development site is located within the Blackwater River (Cork/Waterford) SAC. The proposed development area does not form part of any Natural Heritage Area (NHA), Special Protection Area (SPA), Nature Reserve, or National Park.

4.1 European (Natura 2000) Sites

The proposed development site is located within the Blackwater River (Cork/Waterford) SAC. European sites within the zone of influence of the proposed development site, along with their distance from the proposed development site, are listed in **Table 1** and are shown in **Figure 6** and **Figure 7.**

Table 1. Designated sites and their location relative to the proposed development site.

Natura 2000 Sites	Site Code	Distance at closest point and potential source-pathway-receptor link
Special Area of Conservation (SAC)		
Blackwater River (Cork/Waterford) SAC	002170	0km (within SAC).
Special Protection Area		
Blackwater Callows SPA	004094	1.4km northwest (1.6km downstream)
Natural Heritage Area (NHA) and proposed Natural Heritage Area (pNHA)		
Blackwater River Callows pNHA	000073	480m east
Blackwater Valley (The Beech Wood) pNHA	001797	960m west
Blackwater Valley (Cregg) pNHA	001796	3.7km west
Araglin Valley pNHA	001029	5.1km northeast
Glanworth Ponds pNHA	000085	9.0km northwest
Brown's Farm, Togher Cross Roads pNHA	001169	10.6km northwest
Ballinaltig Beg Pond pNHA	001829	10.7km northwest
Blackwater Valley (Kilcummer) pNHA	001794	10.4km west

Natura 2000 Sites	Site Code	Distance at closest point and potential source-pathway-receptor link
Bride/Bunaglanna Valley pNHA	000079	12.3km southwest

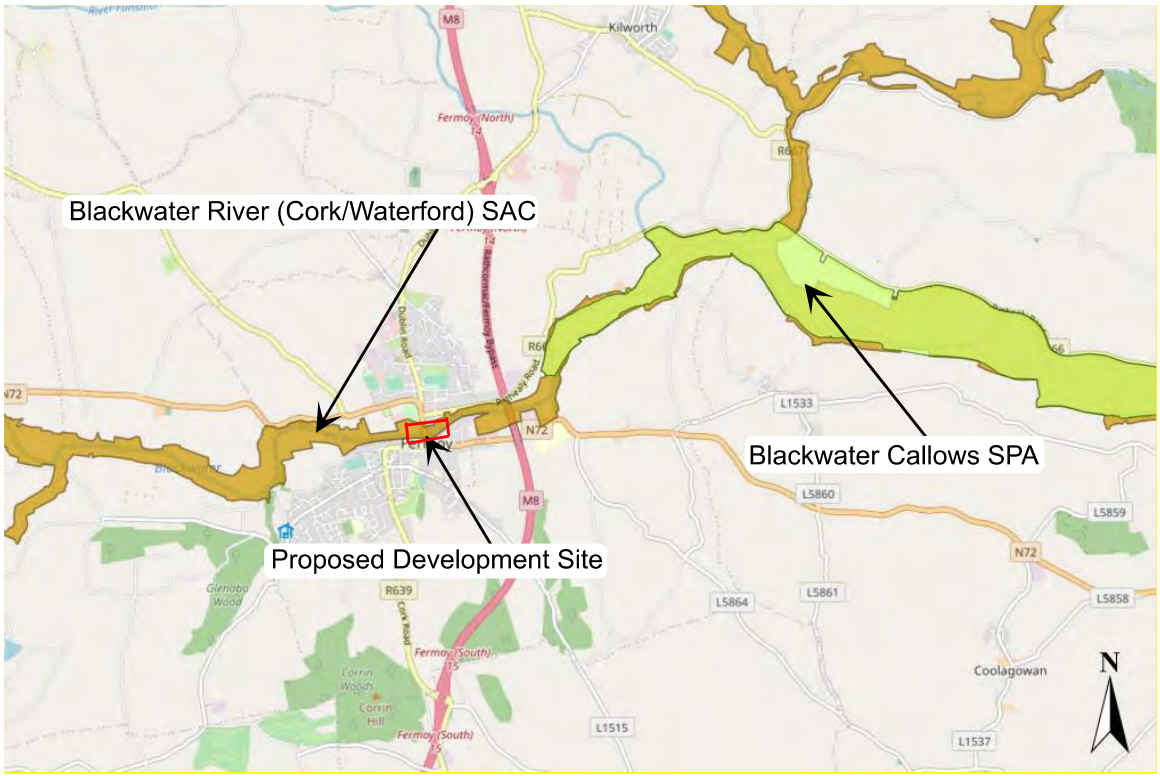

Figure 6. Natura 2000 Sites within zone of influence proposed development site (approximate site boundary) | Source: EPA Envision mapping https://gis.epa.ie/EPAMaps/) | Not to scale

The proposed development site is potentially connected to two Natura 2000 sites (**Table 1**) i.e. River Blackwater (Cork/Waterford) SAC and Blackwater Callows SPA. No pathway exists by which the proposed development could impact on any other Natura 2000 site due to the distances involved and/or the lack of any significant hydrological, hydrogeological or any other relevant connection pathways.

The River Blackwater (Cork/Waterford) SAC is a very large site drains a major part of County Cork and five mountain ranges. The site supports a high diversity of Annex I habitats and Annex II species of the E.U. Habitats Directive, including Atlantic salmon and Otter. The site designated as the Blackwater River cSAC consists of the freshwater stretches of the River Blackwater as far upstream as Ballydesmond and as far downstream as the tidal stretches into Youghal Harbour as well as the many tributaries along the way, the larger of which include the Licky, Bride, Flesk, Chimneyfield, Finisk, Araglin, Awbeg (Buttevant), Clyda, Glen, Allow, Dalua, Brogeen, Rathcool, Finnow, Owentaraglin and Awnaskirtaun. The extent of the Blackwater and its tributaries in this site flows through the counties of Kerry, Cork, Limerick, Tipperary and Waterford. The designated site covers a total area of 15,048ha.

The Blackwater Callows SPA is of importance for its populations of wintering waterfowl, including an internationally important population of Whooper Swan and nationally important

populations of Wigeon, Teal and Black-tailed Godwit. The presence of Whooper Swan, as well as Little Egret, is of particular note as these species are listed on Annex I of the E.U. Birds Directive. Part of the Blackwater Callows SPA is a Wildfowl Sanctuary.

Potential impacts on Natura 2000 sites (SAC/cSAC/SPA) are specifically addressed in a Report for Screening for Appropriate Assessment (AA) and a Natura Impact Statement (NIS) which have been submitted as part of this application. The AA screening report concluded the following:

On the basis of objective information and in view of best scientific knowledge, the possibility of significant effects from the proposed project on a European site, the Blackwater River (Cork/Waterford) SAC, cannot be ruled out and therefore an Appropriate Assessment is required.

The NIS report concluded the following:

It has been objectively concluded following an examination, analysis and evaluation of the relevant information, including in particular the nature of the predicted effects from the proposed development and with the implementation of the mitigation measures proposed, that the construction, operation and decommissioning of the proposed development will not adversely affect (either directly or indirectly) the integrity of any European site, either alone or in combination with other plans or projects. There is no reasonable scientific doubt in relation to this conclusion. The competent authority will make the final determination in this regard.

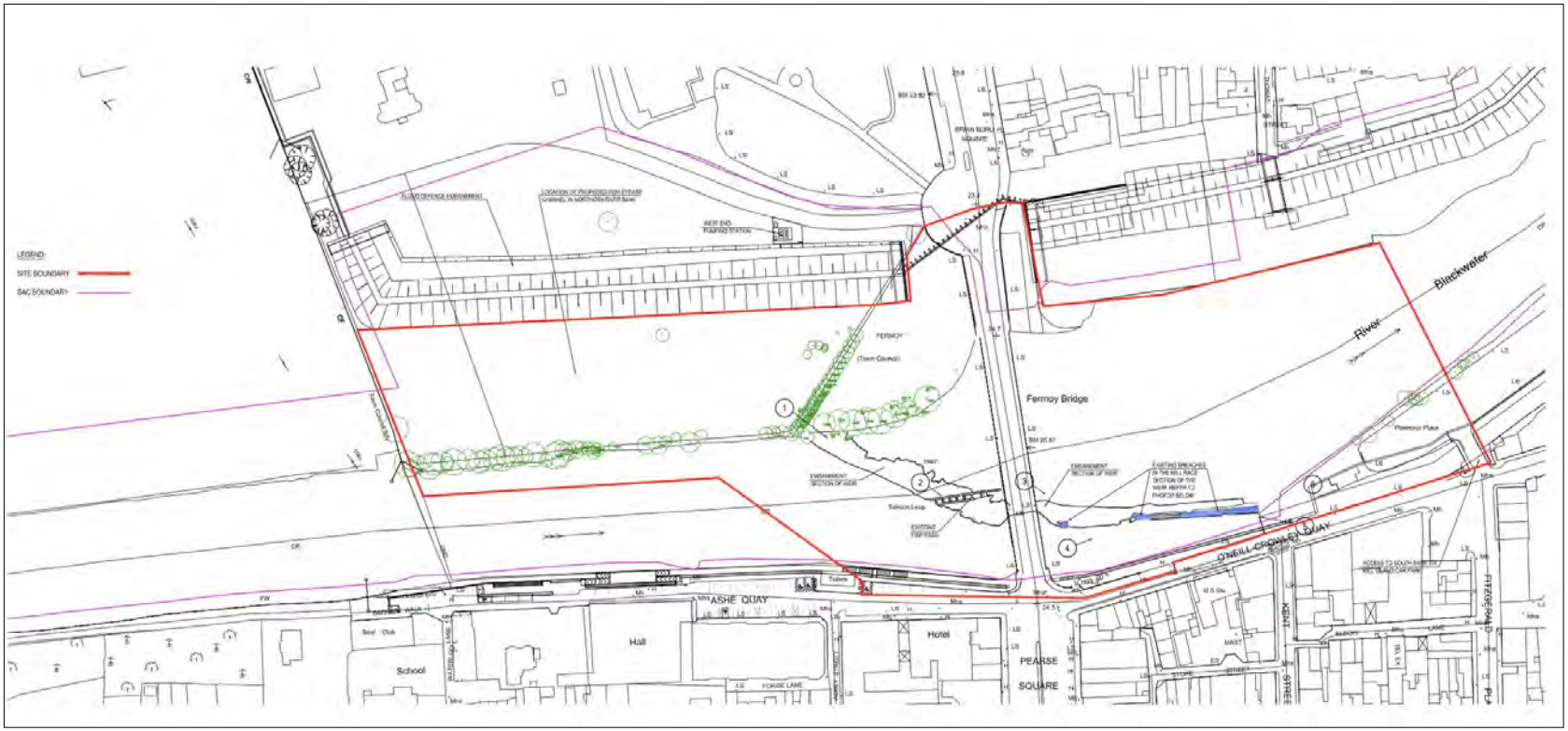

Figure 7. Proposed Development site boundary (red line) and Blackwater River (Cork/Waterford) SAC (pink line)

4.2 Nationally Protected Sites

The NPWS online database identifies eleven Natural Heritage Areas (NHAs) and proposed Natural Heritage Areas (pNHAs) in the vicinity of the proposed development. These are listed in **Table 1** and their distances from the site of the proposed development are provided. The locations of these pNHAs are illustrated in **Figure 8**.

The majority of these NHAs/pNHAs on the River Blackwater are located upstream of the proposed development site. One pNHA is located downstream within 15km of the proposed development site i.e., Blackwater River Callows pNHA (site code 000073). This site largely overlaps with the Blackwater Callows SPA which is discussed in **Section 4.1** above. No source-pathway-receptor link of significance between the proposed development site and any other NHA or pNHA has been identified.

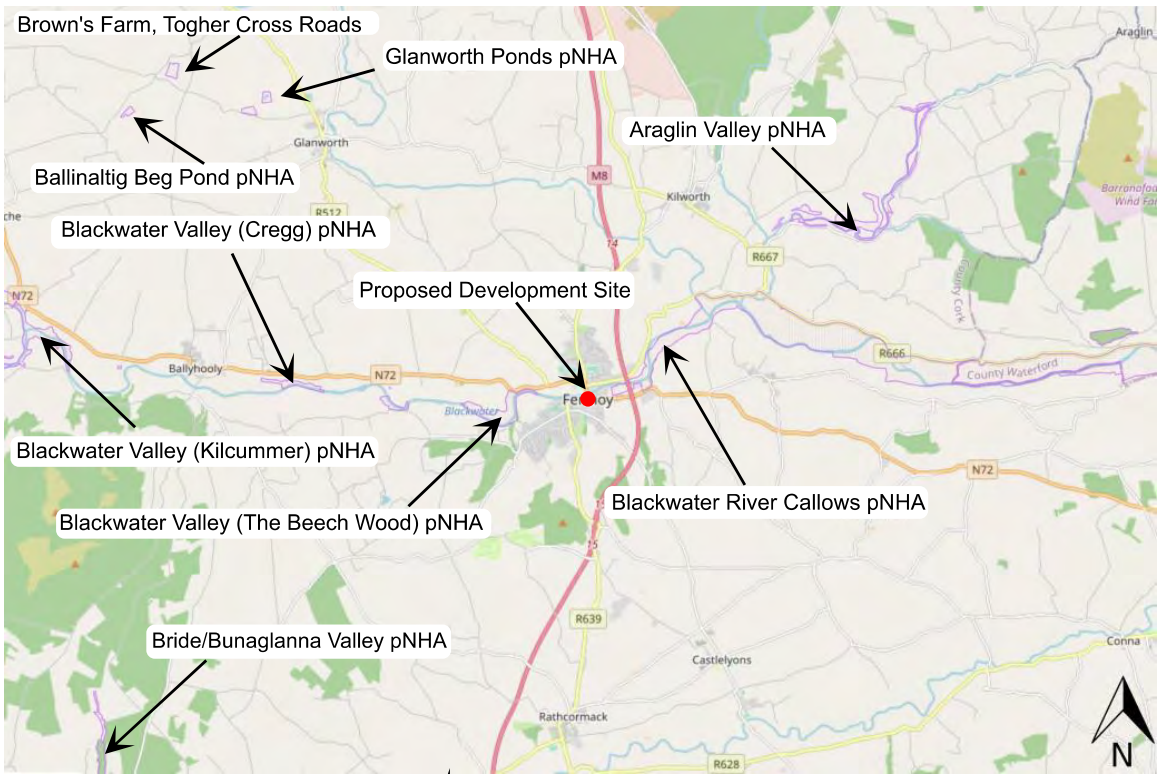

Figure 8. NHAs and pNHAs in the vicinity of proposed development site | Source: EPA Envision mapping (https://gis.epa.ie/EPAMaps/) | Not to scale

4.3 Salmonid Waters – River Blackwater

The River Blackwater main channel is a designated salmonid river in accordance with EU Directive 78/659 (SI No 293 of 1988) and as such receives protection under S.I. No. 293/1988: European Communities (Quality of Salmonid Waters) Regulations, 1988.

The River Blackwater supports resident Brown Trout (*Salmo trutta*), a population of Sea Trout (*Salmo trutta*) in addition to a significant and biologically valuable population of Atlantic salmon (*Salmo salar*). Atlantic Salmon is listed under Annex II and V of the EU Habitats Directive.

4.4 Important Bird Areas – Nagle Mountains

Important Bird and Biodiversity Areas (IBAs) are sites selected as important for bird conservation because they regularly hold significant populations of one or more globally or regionally threatened, endemic or congregator bird species or highly representative bird assemblages. The European IBA programme aims to identify, monitor and protect key sites for birds all over the continent. It aims to ensure that the conservation value of IBAs in Europe (now numbering more than 5,000 sites or about 40% of all IBAs identified globally to date) is maintained, and where possible enhanced. The programme aims to guide the implementation of national conservation strategies, through the promotion and development of national protected-area programmes. Through their designation they aim to form a network of sites ensuring that migratory species find suitable breeding, stop-over and wintering places along their respective flyways.

The function of the Important Bird Area (IBA) Programme is to identify, protect and manage a network of sites that are important for the long-term viability of naturally occurring bird populations, across the geographical range of those bird species for which a site-based approach is appropriate. The proposed development site lies approximately 1.6km south of the Blackwater Callows IBA (Site Code: IE092).

This IBA is described as a narrow flood-plain of the River Blackwater surrounded by parallel sandstone ridges and extending 29 km along the river from Fermoy east to Cappoquin. The site comprises the river itself and adjacent wet grassland along either side. The river flood-plain supports important numbers of wintering waterfowl. Additional species wintering in numbers of national importance are Wigeon *Anas penelope* (4,217 birds, 1996), Teal *Anas crecca* (1,844 birds, 1996), Mallard *Anas platyrhynchos* (844 birds, 1996) and Shoveler *Anas clypeata* (50 birds, 1996).

The IBA is located approximately 1.4km northeast (1.6km downstream) of the proposed development site. Trigger species for the site are listed in **Table 2**. The site qualifies for designation under the following IBA Criteria (2000):

- B1i – Globally near threated species
- B3 – Regionally important congregations
- C2 - The site is known to regularly hold at least 1% of a flyway population or of the EU population of a species threatened at the EU level (listed on Annex I and referred to in Article 4.1 of the EC Birds Directive).
- C3 -The site is known to regularly hold at least 1% of a flyway population of a migratory species not considered threatened at the EU level (as referred to in Article 4.2 of the EC Birds Directive) (not listed on Annex I).
- C6 - The site is one of the five most important in the European region in question for a species or subspecies considered threatened in the European Union.

Table 2. Provides a summary of the Blackwater Callows IBA trigger species.

Species	Current IUCN Red List Category	Season	Year(s) of estimate	Population estimate	IBA Criteria Triggered
Whooper Swan (*Cygnus cygnus*)	LC	Winter	2002-2004	291-344 ind.	B1i, B3, C2, C6
Black-tailed Godwit (*Limosa limosa*)	NT	Winter	2002-2004	638-1,830	B1i, C3

5. Habitats

Habitat surveys were carried out on the 27th of September 2020, 10th of May 2021, 13th of May 2021, 17th of May 2021, 28th May 2021, 19th of July 2021 and 31st July 2021. Habitat mapping was carried out in line with the methodology outlined in the Heritage Council Publication, *Best Practice Guidance for Habitat Survey and Mapping* (Heritage Council, 2011). The terrestrial and aquatic habitats within the proposed development site were classified using the classification scheme outlined in the Heritage council publication *A Guide to Habitats in Ireland* (Fossitt, 2000) and the Environment Agency's *'River Habitat Survey in Britain and Ireland Field Survey Guidance Manual 2003'* (EA, 2003) and cross referenced with Annex I Habitats where required. Further details on habitat surveys are included in **Appendix 2** *Aquatic baseline report for Fermoy Weir, Fermoy, Co. Cork*.

The ecological value of habitats has been defined using the classification scheme outlined in the *Guidelines for Assessment of Ecological Impacts of National Road Schemes* (National Roads Authority, 2009) which is included in **Appendix 1**. It should be noted that the value of a habitat is site specific and will be partially related to the amount of that habitat in the surrounding landscape. Habitats that are considered to be good examples of Annex I and Priority habitats are classed as being of International or National Importance. Semi-natural habitats with high biodiversity in a county context and that are vulnerable, are considered to be of County Importance. Habitats that are semi-natural, or locally important for wildlife, are considered to be of Local Importance (higher value) and sites containing small areas of semi-natural habitat or maintain connectivity between habitats are considered to be of Local Importance (lower value).

The survey area, both upstream and downstream of Fermoy Bridge and Fermoy weir, is located in the Blackwater River (Cork/Waterford) SAC (**Figure 9**) and also within the River Blackwater *Margaritifera* sensitive area. The *Aquatic baseline report for Fermoy Weir, Fermoy, Co. Cork* identified and describes aquatic habitats as detailed below.

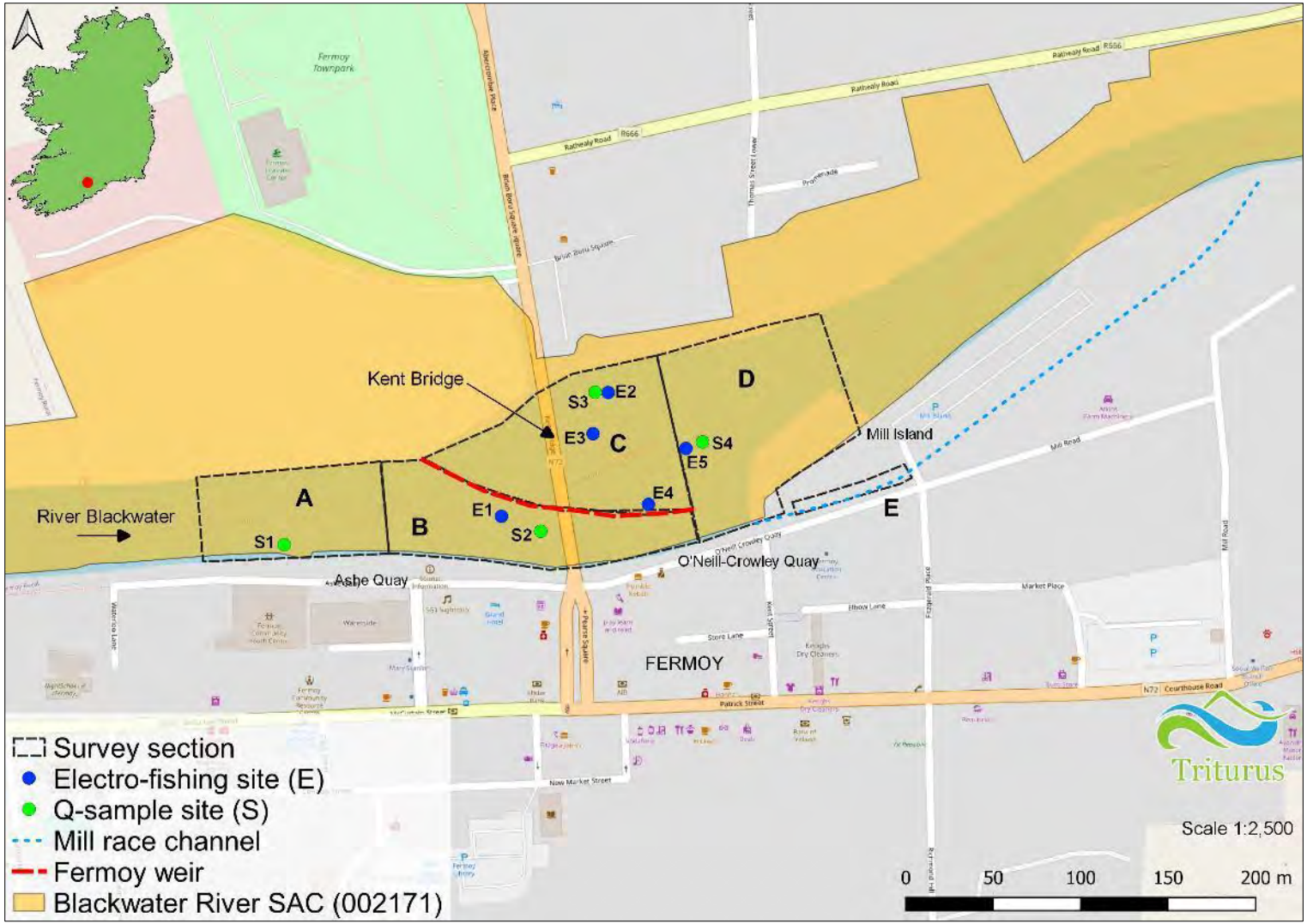

Figure 9. Location of aquatic survey sections in the vicinity of the proposed Fermoy Weir works, Fermoy, Co. Cork

5.1 Aquatic habitats

Section A – >100-200m upstream Fermoy Weir

Section A was located >100-200m upstream of the existing Fermoy Weir structure (**Plate 1**). This section was dominated by homogenous deep glide habitat, with the River Blackwater (Lowland Depositing River, FW2)) averaging 40-50m wide and 2-3m in depth. The river flowed through a deep U-shaped channel, with steep marginal sloping areas. The river channel was highly modified along the south bank, being bound by built land (Buildings and artificial surfaces BL3) and retaining walls approximately 2m above the surface of the river at the time of survey (note: extremely low water levels at the time of survey, May-June 2020). The substrata were dominated by boulder and cobble (60% overall), with patches of coarse gravels. Some sand and silt accumulations were present along the littoral zone of steep river margins. Generally, the substrata were relatively highly bedded with moderate siltation. Instream macrophytes were limited given the mean depth, with sparse marginal growth of Spiked Water Milfoil (*Myriophyllum spicatum*) and Hemlock Water Dropwort (*Oenanthe aquatica*). Instream bryophytes were limited to occasional *Fontinalis antipyretica* on larger boulders. Filamentous algal cover was particularly high at the time of survey, especially in marginal slope areas. Given the paucity of macrophytes upstream of the weir, no good examples of the Annex I habitat 'Water courses of plain to montane levels, with submerged or floating vegetation of *Ranunculion fluitantis* and *Callitricho-Batrachion* or aquatic mosses [3260]' was recorded. No vegetation representative of 'Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels [6430]' was recorded.

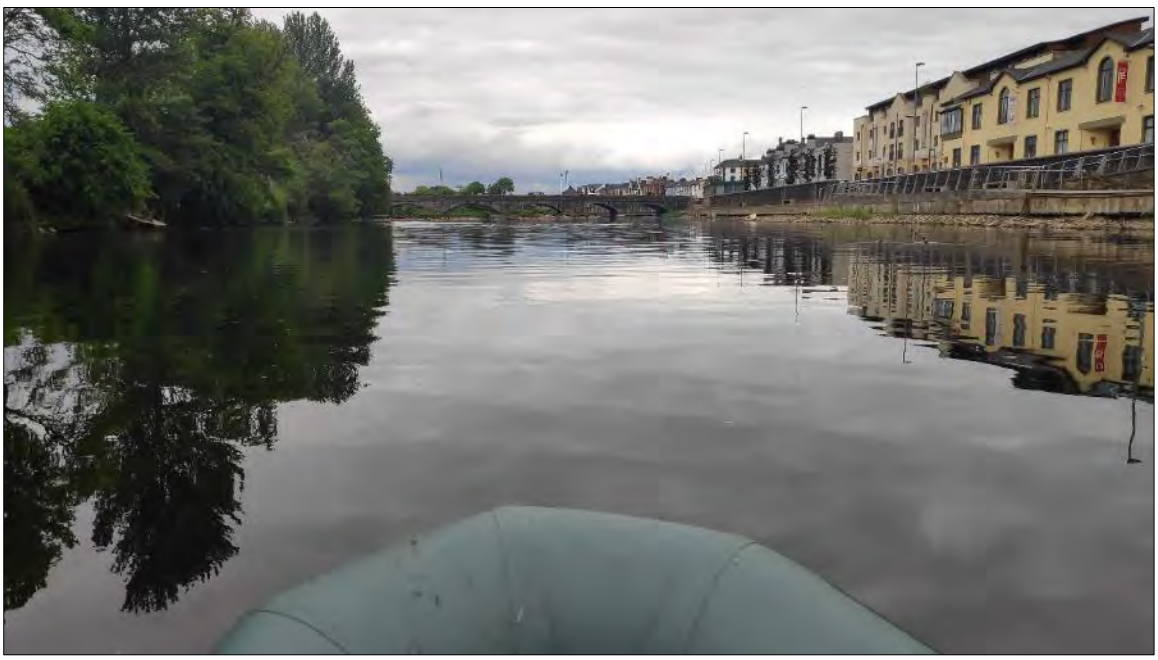

Plate 1. Representative image of Section A >100m upstream of Fermoy Weir, July 2020 (facing downstream towards bridge)

Section B – 0-100m upstream of Fermoy Weir

As per Section A, Section B (located <100m upstream of the existing weir face) was dominated by homogenous deep glide habitat, with the River Blackwater averaging 40-50m wide and 2-2.5m in depth (**Plate 2**). The existing Fermoy Weir structure bisected the section immediately

upstream of Fermoy Bridge. The structure was approximately 150m in length and ran from a NW to SE direction. Significant structural damage was evident along the weir face. The river in Section B flowed through a deep U-shaped channel, with steep marginal sloping areas. The channel was highly modified along the south bank, being bound by built land (BL3) and retaining walls approximately 2m above the surface of the river at the time of survey (note: very low water levels at the time of survey, May-June 2020). The substrata were dominated by boulder and cobble (70% overall), with frequent patches of coarse gravels. Some sand and silt accumulations were present along the littoral zone of steep river margins. Generally, the substrata were bedded with moderate siltation. Instream macrophytes were limited given the deeper water and predominance of hard substrata, with sparse marginal growth of Spiked Water Milfoil and Yellow Water Lily (*Nuphar lutea*) and occasional small stands of Hemlock Water Dropwort on exposed gravel shoals (often inundated at higher water levels). The weir structure supported sparse growth of Hemlock Water Dropwort in addition to the aquatic mosses *Cinclidotus fontinaloides* and *Fontinalis antipyretica* on the wetted faces. Filamentous algal cover was particularly high at the time of survey, especially in marginal slope areas. Given the paucity of macrophytes upstream of the weir, no good examples of the Annex I habitat 'Water courses of plain to montane levels, with submerged or floating vegetation of *Ranunculion fluitantis* and *Callitricho-Batrachion* or aquatic mosses [3260]' was recorded.

Plate 2. Representative image of Section B (0-100m upstream of Fermoy Weir), June 2020 showing old fish pass, facing downstream towards bridge.

Section C – 0-100m downstream Fermoy Weir

Section C, located downstream of the existing weir structure, featured faster and more heterogeneous flows than upstream. Structural damage to the weir in recent years had resulted in accelerated deep (>1.5m) fast glide habitat along the south bank (main flow), feeding a large, deep pool approximately 30m downstream of Fermoy Bridge, along O'Neill-Crowley Quay (**Plates 3-5).** The river along the south bank was considerably shallower (<1m, often <0.5m) and dominated by riffle and shallow glide habitat, with pool-like/eddy habitat pool located in the vicinity of the bridge (i.e. between weir face and islands). Overall, the substrata

were dominated by well-mixed gravels and small cobble in most areas. Fine sediment (silt and clay) accumulations were associated with instream macrophyte beds and had caused some local bedding of substrata. However, overall, the substrata were generally mobile and free from sedimentation. At low water levels, numerous small islands of exposed gravel and cobble were present immediately downstream of the bridge. The lee of these islands supported fine sediment accumulations ranging from 1-10cm in depth and offered good lamprey potential.

In contrast to upstream, macrophyte cover was high with growth dominated by Water Crowfoot (*Ranunculus* subspecies *Batrachion* agg.) vegetation, which formed large stands along the shallow fast glide of the north bank, downstream of the bridge (30% cover overall). Spiked Water Milfoil was also locally frequent with occasional *Callitriche* sp. between islands/gravel shoals and along muddy river margins. Small, localised stands of Unbranched Bur-reed (*Sparganium emersum*) were also present. *Fontinalis antipyretica* was recorded very locally on large cobble. The moss species *Cinclidotus fontinaloides* was very abundant along the dry weir faces. Given the presence of ≥3 indicator species (see EC, 2013), the macrophyte community recorded was considered representative of the Annex I habitat 'Water courses of plain to montane levels, with submerged or floating vegetation of *Ranunculion fluitantis* and *Callitricho-Batrachion* or aquatic mosses [3260]'.

Plate 3. Representative image of the downstream extent of Section C (0-100m downstream of Fermoy Weir), June 2020.

Plate 4. Representative image of Section C (0-100m downstream of Fermoy Weir), July 2020 showing existing wall (right) and mid-channel islands (left).

Plate 5. Representative image of Section C (0-100m downstream of Fermoy Weir), July 2020 facing upstream towards Fermoy Bridge from the O'Neill Crowley Quay retaining wall (large weir pool located in the right foreground was located within Section D).

Section D - >100-200m downstream Fermoy Weir

Section D, located ≥100m downstream of the existing weir structure, was dominated by very fast glide and pool habitat, invariably <1m in depth. Deeper glide and pool was present >200m downstream (i.e. towards the downstream extent of Mill Island). The large pool associated with the existing weir, along O'Neill-Crowley Quay (**Plate 6 and 7**), ranged from 2-2.5m in depth at the time of survey (i.e. low water levels). Standing water/ponding (<0.3m max. depth) was present on and to the south of the large, exposed gravel island (usually mostly inundated at normal water levels). In the river channel the substrata were dominated by cobble and coarse gravel. Large cobble and limited large boulders were present in the weir pool. Given high flow rates, the substrata were generally mobile and free from sedimentation although some shallow silt/sand accumulations were present in marginal slacks and in association with macrophyte beds.

In terms of macrophytes, *Ranunculus* subspecies *Batrachion* agg. vegetation was present but was localised in the main channel downstream of the pool and island (10% cover). Some limited Spiked Water Milfoil and *Callitriche* sp. were present at the Section C-D interface. *Fontinalis antipyretica* was recorded very locally on larger cobble and boulder. Given the presence of ≥3 indicator species (EC, 2013), the macrophyte community recorded was considered representative of the Annex I habitat 'Water courses of plain to montane levels, with submerged or floating vegetation of *Ranunculion fluitantis* and *Callitricho-Batrachion* or aquatic mosses [3260]'.

Plate 6. Representative image of Section D (>100-200m downstream of Fermoy Weir), June 2020, facing downstream from the largest mid-channel island near Fermoy Bridge.

Plate 7. Representative image of Section D, July 2020, facing upstream towards Fermoy Bridge.

Section E – Mill-race channel

Site E represented the uppermost 100m of a disused Mill Race channel, that averaged 7-8m and 0.3-0.5m in depth at the time of survey. The channel was not located within the Blackwater River (Cork/Waterford) SAC site (**Figure 9**). Held between 2-3m-high retaining walls, the channel diverged from the River Blackwater through a flood wall (formerly sluice gates) near the weir pool along O'Neill-Crowley Quay/Mill Road. The channel rejoined the main river approximately 400m downstream. The channel supported standing water only at the time of survey (100% pool habitat), although it was known to convey significantly higher water volumes, seasonally. The channel substrata were dominated by deep silt, often >0.5m in depth. Otter prints (recently made) were recorded in the muddy paludal under the road bridge to the Mill Island car park (ITM 581346,598612).

The site was heavily-vegetated and supported a diverse macrophyte and riparian plant community. Instream, Unbranched Bur-reed was abundant, with frequent Canadian Pondweed (*Elodea canadensis*), Broad-leaved Pondweed (*Potamogeton natans*) and Common Duckweed (*Lemna minor*). *Callitriche* sp. and Water Plantain were occasional. Given the presence of only two indicator species (*Potamogeton* sp. and *Callitriche* sp.; EC, 2013), the macrophyte community did not correspond to the Annex I habitat 'Water courses of plain to montane levels, with submerged or floating vegetation of *Ranunculion fluitantis* and *Callitricho-Batrachion* or aquatic mosses [3260]'.

The margins of the channel, exposed to occasional inundation, supported abundant Reed Canary Grass with Flowering Rush, Fool's Watercress (*Apium nodiflorum*), Water Mint, Blue Water Speedwell (*Veronica anagallis-aquatica*), Bittersweet (*Solanum dulcamara*) and Redshank (*Persicaria maculosa*). Given the good species diversity, the plant community of the upper reaches of the mill-race channel was considered representative of the Annex I habitat 'Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels [6430]'.

Plate 8. Representative image of site E, the heavily vegetated mill-race channel downstream of the proposed works area, July 2020.

Plate 9. Representative image of marginal vegetation including flowering rush representative of the Annex I habitat 'Hydrophilous tall herb [6430]', July 2020.

5.2 Sonar Survey

As anticipated, the boat-based SONAR survey revealed a clear differential in the bathymetric profile upstream and downstream of the weir (Refer to **Appendix 2 Figure 3.2**). Upstream of the existing weir (i.e. survey Section A and most of Section B) featured deeper glide habitat averaging 1.5-2.5m, while downstream the average depth of the areas dominated by faster-

flowing glide habitat averaged 0.5-<1.5m. Although some locally deeper pool areas were present, the majority of survey sections C and D (downstream of the weir) were ≤1m in depth.

The plots of river hardness (**Appendix 2 Figure 3.3**) and riverbed rugosity (**Appendix 2 Figure 3.4**) illustrated the dominance of softer substrata in the shallower areas, such as those in the vicinity of mid-channel islands downstream of Fermoy Bridge. These areas are indicated by higher relative scores in both the river hardness and rugosity maps (**Appendix 2 Figures 3.3 & 3.4**). In this respect silt dominated areas are softer and smoother as reflected in the scores and concentrated in the northern half of the River Blackwater channel downstream of the weir. The deeper glide and pool areas (e.g. sections A and D) supported harder substrata with higher rugosities (greater substrata complexity/ roughness) with very localised lamprey ammocoete habitat (as illustrated by the dark red banding on **Appendix 2 Figures 3.3 & 3.4**).

5.3 Floating River vegetation

Macrophyte communities representative of the Annex I habitat ‘‘Water courses of plain to montane levels, with submerged or floating vegetation of *Ranunculion fluitantis* and *Callitricho-Batrachion* or aquatic mosses [3260]’ (‘floating river vegetation’, FRV) were present within the River Blackwater survey area. Sections C and D, downstream of Fermoy Weir, supported frequent *Ranunculus* subspecies *Batrachion* agg. in addition to other indicator species (EC, 2013) including Callitriche sp., *Myriophyllum spicatum* and the moss *Fontinalis antipyretica*. The better-quality areas of FRV habitat could be considered as those featuring an overall higher percentage cover, i.e. survey Section C downstream of Fermoy Bridge, along the north bank. Given the paucity of macrophytes, no good examples of this Annex I habitat were present upstream of the weir (survey sections A and most of B).

5.4 Hydrophilous tall herb habitat (non-qualifying interest)

Of note, are several vegetated gravel islands located in the River Blackwater downstream of Fermoy Weir supported the non-qualifying interest Annex I habitat ‘Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels [6430]’. A number of positive indicator species (EC, 2013; Devaney *et al*., 2013) were recorded on exposed gravel shoals and their margins including *Epilobium hirsutum*, *Lythrum salicaria*, *Mentha aquatica*, *Myosotis scorpioides, Stachys palustris* and *Alisma plantago-aquatica*. River gravel islands (bars) are classified as vulnerable in the European Red List of Habitats, based on the criterion of a large reduction in the habitat area over the last 50 years (about 35%; Janssen *et al*., 2016). Such islands are ephemerally inundated at higher flows and subject to wetting and drying processes with changing water levels, thereby alternately offering terrestrial, wet and aquatic habitats (Zeng *et al.,* 2015). Gravel bars and partially vegetated islands, such as those found downstream of Fermoy Weir, are key components of gravel-bed rivers (Edwards *et al*., 1999; Tockner *et al.,* 2006) and are naturally highly dynamic and morphologically complex systems. Therefore, gravel islands represent important instream habitat at the aquatic-terrestrial interface. In having an ecotonal position between aquatic and terrestrial environments, bars have the potential to support a varied and rich biota (Kalníková *et al*., 2020; Gilvear *et al.,* 2007).

Good examples of the Annex I hydrophilous tall herb habitat were also present in the Mill Race channel (survey Section E), located outside of the Blackwater River (Cork/Waterford) SAC

boundary, as well as along the northern river margins of survey Section C (downstream of the bridge) and to the south of the large gravel island near Mill Island (Section D).

5.5 Aquatic habitat evaluation

An ecological evaluation of the survey area was based on the results of the aquatic surveys. All aquatic survey areas on the River Blackwater (i.e. sections A-D) were considered of International importance as they form part of the Blackwater River (Cork/Waterford) SAC (002170). These survey sections were also considered of high value given the presence of qualifying interest *Lampetra* sp. ammocoetes, Atlantic Salmon, White-clawed Crayfish and Otter in addition to the Annex I habitats 'Water courses of plain to montane levels, with submerged or floating vegetation of Ranunculion fluitantis and Callitricho-Batrachion or aquatic mosses [3260]' (sections C and D) 'Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels [6430]' (sections C and D).

The Mill Race channel (survey Section E) was located outside of the Blackwater River (Cork/Waterford) SAC boundary. However, given that the channel supported Otter and herbaceous vegetation representative of the Annex I habitat 'Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels [6430]', survey Section E was considered of local importance (higher value).

5.6 Terrestrial habitats

Section A – >100-200m upstream Fermoy Weir

In Section A the north bank featured a scattered mature riparian treeline (WL2) comprised of Sycamore (*Acer psuedoplatanus),* Elder (*Sambucus nigra*), Ash (*Fraxinus excelsior*), Aspen (*Populus tremula*), Hawthorn (*Crataegus monogyna*), Hazel (*Corylus avellana*), occasional Alder (*Alnus glutinosa*) and Wych elm (*Ulmus glabra*). The scrubby understorey was dominated by Bramble (*Rubus fruticosus* agg.) and nettle (*Urtica dioica*). Reed Canary Grass (*Phalaris arundinacea*) was common along channel margins, more so on the north bank.

Section B – 0-100m upstream of Fermoy Weir

In Section B the north bank featured a scattered mature riparian treeline (WL2) comprised of Sycamore*,* Elder, Ash, Aspen, Hawthorn, Hazel and occasional Alder and Wych Elm. The scrubby understorey was dominated by Bramble and Nettle. The river was bordered by improved agricultural grassland (GA1) to the north. No vegetation representative of 'Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels [6430]' was recorded.

The weir and bridge in this area have been classified as Buildings and artificial surfaces (BL3) This habitat type includes the entirety of the Fermoy Bridge, as well as a section of paved park entrance and adjacent paths, and a small carpark north of the bridge. It also includes sections of footpath south of the bridge and a large carpark to the southeast of the bridge, as well as two smaller bridges connecting this carpark to O'Neill-Crowley Quay. While the weir structure supports limited vegetation (See **Section 5.1**), as noted in **Section 7.1** below, the weir is frequently used by Otter.

Section C – 0-100m downstream Fermoy Weir

Along Section C, the river channel was bordered to the north by a mature treeline (WL2) comprising Alder, Ash and Sycamore with Elder, Willow and Hawthorn adjoining improved agricultural grassland (pasture). The south (town) bank along O'Neill-Crowley Quay was bound by retaining walls (Stonewalls and other stonework BL1). The north bank of the river immediately downstream of the bridge featured muddy paludal areas supporting localised Great Yellow-cress (*Rorippa amphibia*), Hemlock Water Dropwort, Pink Water Speedwell (*Veronica catenata*) and Water-forget-me-not (*Myosotis scorpioides*) (Tall-herb swamp FS2). These littoral species graded into more extensive swards of Reed Canary Grass on drier ground (including islands). Muddy areas below the water line supported occasional stands of Flowering Rush (*Butomus umbellatus*) (one large 10m^2 stand) and infrequent Branched Bur-reed (*Sparganium erectum*). The upper drier gravel areas of instream islands supported Great Willowherb (*Epilobium hirsutum*), Marsh Willowherb (*Epilobium palustre*), Ribwort Plantain (*Plantago lanceolata*), Common Figwort (*Scrophularia nodosa*), Charlock (*Sinapis arvensis*), Vetch (*Vicia* sp.), Creeping Yellowcress (*Rorippa sylvestris*), Bittercress (*Cardamine* sp.) and Marsh Woundwort (*Stachys palustris*). Exposed gravel and cobble littorals of such instream islands also supported frequent Redshank (*Persicaria maculosa*), Water Pepper (*Persicaria hydropiper*) and Fat Hen (*Chenopodium album*) with less frequent patches of Hemlock Water Dropwort. Curled Dock (*Rumex crispus*) and Creeping Yellowcress were more localised. The muddy margins of these islands supported Water Plantain (*Alisma plantago-aquatica*) and Water Mint (*Mentha aquatica*). Himalayan Balsam (*Impatiens glandulifera*) was occasional. Given the presence of ≥3 indicator species (see Devaney *et al.* 2013), the Annex I habitat 'Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels [6430]' was also recorded in association with mid-channel islands and along the north bank of the river (downstream of Fermoy Bridge).

Section D - >100-200m downstream Fermoy Weir

The river channel around Section D was bordered to the north and south by a mature treeline (WL2) comprising Alder, Ash and Sycamore with Elder, Willow and Hawthorn. Reed canary grass formed large stands on island centres with inundation zones colonised by annuals of exposed gravel. The upper drier gravel areas of instream islands supported Great Willowherb, marsh Willowherb, Ribwort Plantain, Common Figwort, Charlock, Vetch (*Vicia* sp.), Creeping Yellowcress, Bittercress (*Cardamine* sp.) and Marsh Woundwort (Tall-herb swamp FS2). Exposed gravel and cobble littorals of such instream islands also supported frequent Redshank, Water Pepper and Fat Hen with less frequent patches of hemlock water dropwort. Curled Dock and Creeping Yellowcress were more localised. The muddy margins of these islands supported water plantain and Water Mint. Himalayan Balsam was occasional. Given the presence of ≥3 indicator species (see Devaney *et al*. 2013), the river islands supported good examples of the Annex I habitat 'Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels [6430]'.

Section E – Mill-race channel

Good examples of the Annex I habitat 'Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels [6430]' was also present in the Mill Race channel (survey Section E), located outside of the Blackwater River (Cork/Waterford) SAC boundary, as well

as along the northern river margins of survey Section C (downstream of the bridge) and to the south of the large gravel island near Mill Island (Section D).

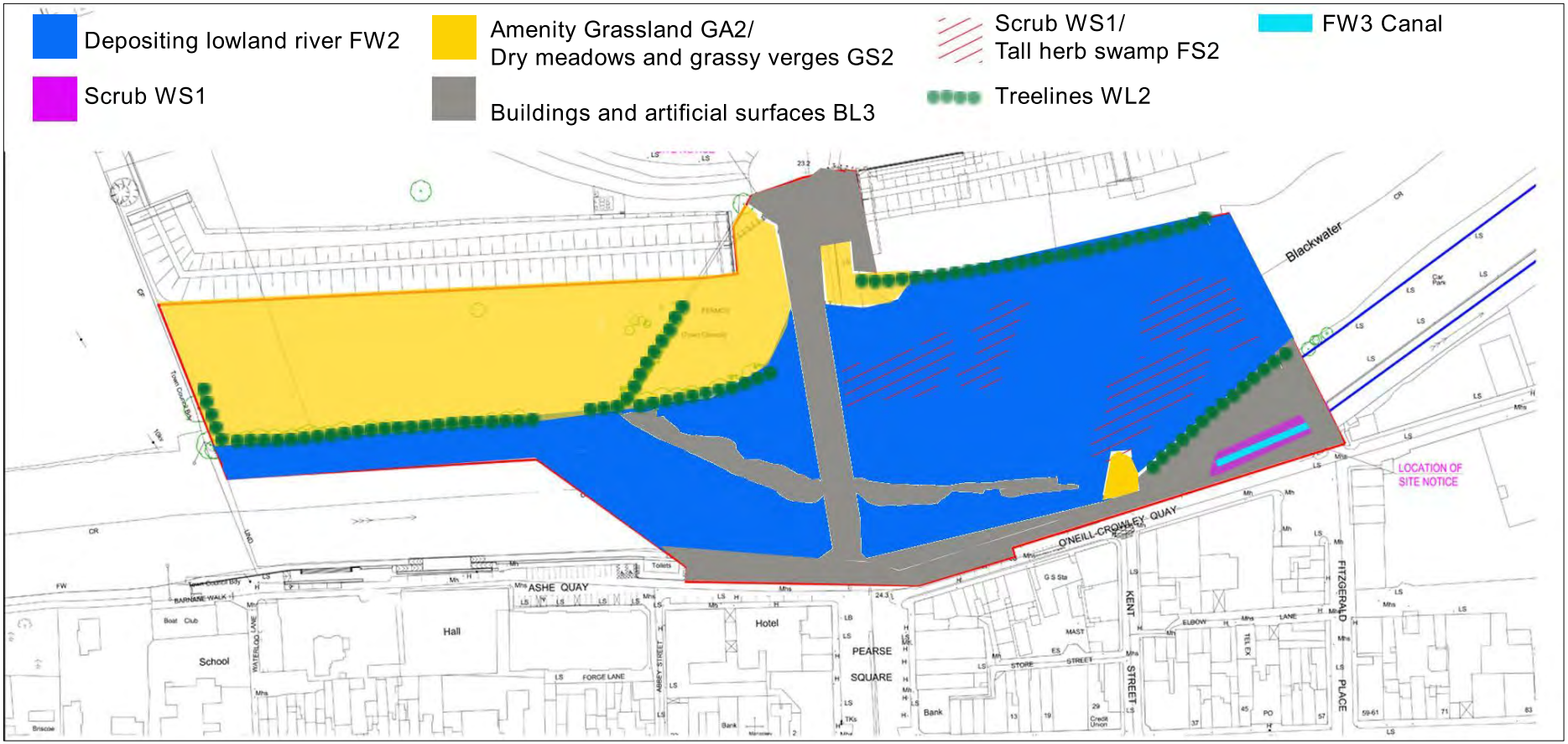

Figure 10. Habitats within proposed development site boundary (Fossitt 2000)

Other terrestrial habitats

Treelines WL2

Treelines border the River Blackwater on the northern and southern banks of the proposed development site (Figure 10). These include the site's western border, along the north bank of the river on either side of the bridge, and along the south bank of the river east of the bridge, bordering the larger carpark. These treelines are dominated by mature trees (See **Appendix 4** for further detail). The exact composition of species in each location differs. The western-most treeline and the treeline along the north bank of the river are composed primarily of Ash *Fraxinus excelsior*, Willow, Sycamore *Acer pseudoplatanus* and Small-Leaved Lime *Tilia cordata*. The understory is dominated by Nettle *Urtica dioica*, Bindweed *Calystegia sepium* and Winter Heliotrope *Petasites pyrenaicus*. West of the bridge, the treeline splits. Its northern section is composed almost solely of planted Lawson's Cypress *Chamaecyparis lawsoniana*. The southern section is dominated by Wych Elm *Ulmus glabra*, Beech and Small-Leaved Lime. East of the bridge, a treeline runs along the north bank of the river. It is dominated by Sycamore, Willow, Ash and Cherry Laurel *Prunus laurocerasus*. This treeline is wider (2-3m) than any other within the development area with mature trees.

The treeline running along the southern bank, east of the bridge, has Horse Chestnut *Aesculus hippocastanum*, Alder, Willow, Sycamore and Ash as its dominant trees, and Bramble *Rubus fruticosu*s and Ivy *Hedera helix* as part of its understory.

Amenity Grassland GA2/Dry meadows and grassy verges GS2

An area of Amenity Grassland GA2/Dry meadows and grassy verges GS2 is located on the northern banks of the River Blackwater (**Figure 10**). This grassland is bounded to the south by a treeline which borders the River Blackwater as well as line of Poplar which runs through this grassland area. A grassy embankment, part of the Fermoy Flood Relief scheme borders the north of this grassland habitat. A section of non-fertilized, infrequently-mown grassland is present west of the bridge. Parts of it are signposted to show that it has been seeded with wildflowers and allowed to grow. The grass was tall (50-80cm) at the time of surveying. Clumps of False Oatgrass *Arrhenatherum elatius* and Purple Moorgrass *Molinia Caerulia* are common. The broadleaved herb component includs Creeping Cinquefoil *Potentilla reptans* and Red Clovers *Trifolium pratense*. Curled Dock *Rumex crispus*, Nettle *Urtica dioica* and Common Knapweed *Centauria nigra* are dominant. Meadowsweet *Filipendula ulmaria* is also common. Smaller areas of this habitat are also present in two places east of the bridge.

Scrub WS2/Tall herb swamp FS2

Within the river channel are various deposits of sediment, gravel banks, and small islands that are covered by scrub. These are likely to be partially or wholly inundated during flood events and as such the vegetation found here is stunted and they are not stable over time. At low water levels exposed gravel and cobble were present immediately downstream of the bridge. The Annex I habitat '*Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels [6430]*' (FS2) was also recorded in association with mid-channel islands and along the north bank of the river (downstream of Fermoy Bridge). Stunted Willow trees and Bramble are dominant here. As these patches of land are small, the influence of the surrounding river means that wetland grasses are also common, including Purple Moorgrass

and Creeping Bent *Agrostis stolonifera*. This habitat is located within the SAC and therefore has been classified as internationally important.

Scrub habitat was also recorded on the margins of the Mill Race, which is located outside the SAC boundary.

Canal FW3

Site E represented the uppermost 100m of a disused Mill Race channel, that averaged 7-8m and 0.3-0.5m in depth at the time of survey. The channel was not located within the Blackwater River (Cork/Waterford) SAC site. Held between 2-3m-high retaining walls, the channel diverged from the River Blackwater through a flood wall (formerly sluice gates) near the weir pool along O'Neill-Crowley Quay/Mill Road. The channel rejoined the main river approx. 400m downstream. The channel supported standing water only at the time of survey (100% pool habitat), although it was known to convey significantly higher water volumes, seasonally. The channel substrata were dominated by deep silt, often >0.5m in depth.

5.6.1 Alluvial Woodland

The Annex I habitat 91E0 corresponds to four vegetation types described in Perrin *et al.* (2008). Three are in the *Alnus glutinosa – Filipendula ulmaria* group: *Fraxinus excelsior – Carex remota* type; *Alnus glutinosa – Rubus fruticosus* type; and *Salix cinerea – Equisetum fluviatile* type. The fourth type is in the *Fraxinus excelsior – Hedera helix* group: the *Salix-triandra – Urtica dioica* type.

91E0 is a priority Annex I habitat. A number of variants of this woodland habitat exist, of which riparian forests of *Fraxinus excelsior* and *Alnus glutinosa* of temperate and Boreal Europe lowland and hill watercourses (habitat 44.3 Alno-Padion of the Palaearctic habitat classification of Devillers & Devillers-Terschuren (1993), cited in European Commission (2007)) are the most common type to be found in Ireland. European Commission (2007) states that all types occur on heavy soils that are periodically inundated by the annual rise of river levels, but that are otherwise well drained and aerated during low water. The herbaceous layer includes many large species such as *Filipendula ulmaria, Angelica sylvestris* and *Carex acutiformis,* vernal species such as *Ranunculus ficaria* and *Anemone nemorosa*, and other indicative species such as *Carex remota, Lycopus europaeus, Urtica dioica* and *Geum rivale*.

A functioning alluvial forest with a good structure is, in common with sessile oak woods, a multi- layered system, although the individual layers may be less distinct than in oak woods. Non-native species should be no more than occasional, with a cover not exceeding 10%, and preferably absent, although an exception is made for gallery woodlands in which non-native species of *Salix*, such as *S. fragilis* or *S. alba,* may be frequent. Typical canopy species include *Salix* spp., *Fraxinus excelsior* and *Alnus glutinosa*, one or more of which should make up the greater proportion of the canopy. *Betula* spp. and *Crataegus monogyna* are frequently found, with other tree species such as *Quercus robur* and *Ulmus glabra* occurring in drier examples of the habitat.

The habitat *Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae) 91E0* does not occur in proximity to the proposed development site. The terrestrial habitats located adjacent to the proposed development site includes an area of treelines (WL2) on the northern shores of the River Blackwater, upstream of the existing weir.

This area of trees is a dry site with coarse loamy drift soil and siliceous stones. This site is liable to flooding as it is below the town's flood defences and part of a recreational area, open to the public. Although these trees are located within the Blackwater River (Cork/Waterford) SAC, they have been classified as Treelines WL2 habitat which is not an Annex I habitat or a qualifying habitat for the SAC.

According to NPWS (2012), the area of alluvial woodland within the SAC should be stable or increasing, subject to natural processes i.e., at least 19.2ha for sites surveyed. This is a minimum area based on six sites surveyed by Perrin *et al.* (2008). However, the publication notes that further unsurveyed areas are almost certainly present within the SAC. There are no mapped areas of 91E0 habitat in the vicinity of the proposed development site and the closest mapped area is located approximately 20km upstream (i.e. NSNW 1464).

Based on desktop review and field surveys, a small, wooded island within the River Blackwater channel located 700m upstream of Fermoy Bridge was identified as potentially supporting Alluvial woodland habitat and this site was the focus of a detailed survey to determine if the woodland at this location could be classified as this Annex I habitat (**Figure 11**). Species recorded within the survey area are listed in **Table 3**.

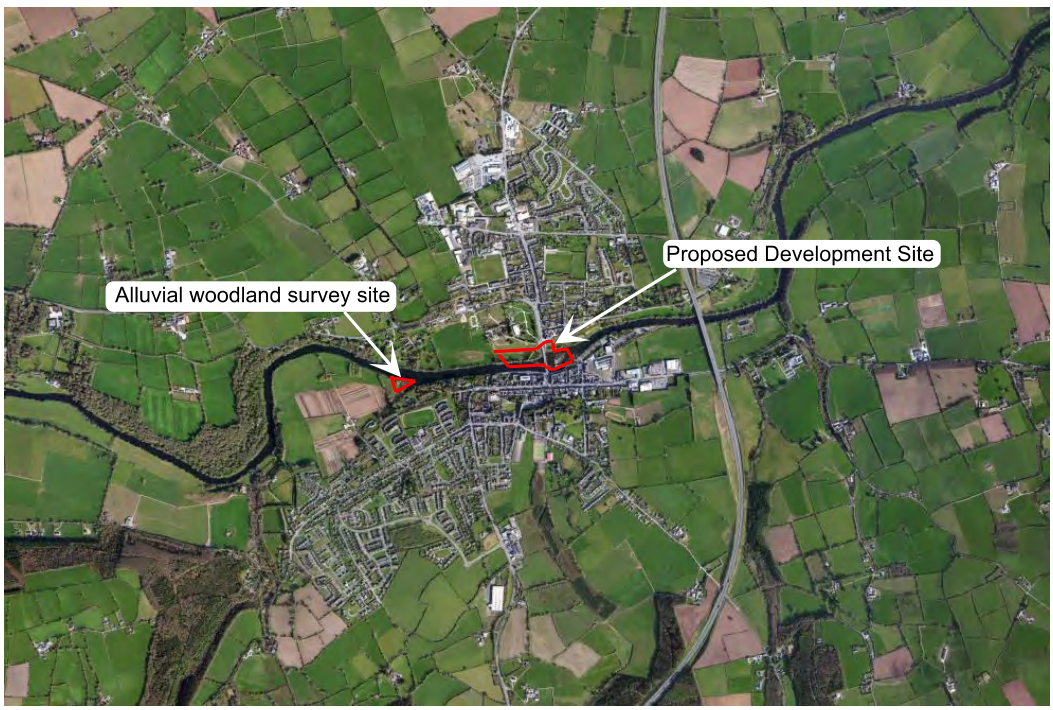

Figure 11. Alluvial woodland survey site

Table 3. Species recorded within Alluvial woodland survey area

Alluvial woodland survey area
Dominant ground flora:
Scaly male fern *Dryopteris affinis*
Pendulum sedge *Carex pundula*
Wood melick *Melica uniflora*

Alluvial woodland survey area
Reed Canary-Grass *Phalaris arundinacea* Other ground flora: Ivy *Hedera helix* Woundwort *Stachys* spp Galium aparine *Angelica sylvestris* Meadowsweet *Filipendula ulmaria* Cow Parsley *Anthriscus sylvestris* Himalayan Balsam *Impatiens glandulifera* Ground Ivy *Glechoma hederacea* Enchanter's Nightshade *Circaea lutetiana* Bindweed *Calystegia sepium* Wood Dock *Rumex sanguineus* Creeping Buttercup *Ranunculus repens* Nettle *Urtica dioica*
Tree Species: Grey Poplar *Populus x canescens* Crack willow *Salix fragilis* Grey willow *Salix cinerea* Ash *Fraxinus excelsior* Sycamore *Acer pseudoplatanus* Pedunculate Oak *Quercus robur* Beech *Fagus sylvatica* Holly *Ilex aquifolium* Alder *Alnus glutinosa* Bay Tree *Laurus nobilis* Dogwood *Cornus* spp Hawthorn *Crataegus monogyna* Yew *Taxus baccata*
Tree canopy: 10% Grey poplar *Populus x canescens*

Alluvial woodland survey area
30% Sycamore *Acer pseudoplatanus*
10% Beech *Fagus sylvatica*
20% Ash Fraxinus excelsior
10% Willow Salix spp
10% Alder *Alnus glutinosa*
10% other/open space

The survey area appears to have been planted in the 18th century with both non-native and native willow species present. This area is no longer a distinct island but the channel between the island and the riverbank is regularly flooded. Ash, Alder and Willow *Salix spp*. account for approximately 40% of the total woodland at the site (20%, 10% and 10% respectively). However non-native species e.g., Sycamore *Acer pseudoplatanus* account for a significant amount of tree cover i.e., >10%. Notwithstanding that ground flora is typical of riparian woodland, this is not a significant example of the Annex I habitat Alluvial woodland.

5.6.2 Tree Survey

The proposed works will encroach on amenity/recreation land and will necessitate the removal of riverside trees and a parkland tree line. These trees were surveyed on 31st July 2021 following the standards outlined in BS 5837 (2012). The trees are on the north bank upstream of Fermoy Bridge close to the existing weir and fish bypass channel. It is a dry site with coarse loamy drift soil and siliceous stones but it is liable to flooding as it is below the town's flood defences and part of a recreational area which is open to the public. The survey area is within the Blackwater River (Cork/Waterford) SAC. Full details of this tree survey are included in **Appendix 4** of this report.

The aim of the tree survey was to:

- To establish a baseline tree survey and description of the trees on the site with particular regard to safety management recommendations and an Arboricultural Method Statement,
- To provide an assessment of arboricultural impacts for the proposed development and
- To identify trees to be retained and provide recommendations for their management.

The surveyed trees can be broadly divided into three phases of establishment:

1. Parkland planting, early 1800's.
2. Amenity planting 1980's.
3. Naturally regenerated trees, post 1900.

Parkland Planting

This parkland planting forms part of the Fermoy House landscaping and dates from the early 1800's. Nine trees along the riverbank, all non-native Lime *Tilia* sp., date from this period. Six are within the proposed fish bypass channel footprint- 51,52,56,57,60 and 74 and will need to be removed. Trees 51,52,56 and 60 are very large prominent trees and two – 57 and 74 consist of low regrowth from the cut stumps of original trees. These trees will be removed as they are within the fish bypass channel footprint.

Outside the proposed fish bypass channel footprint three Lime trees will be retained (69,70 and 71). However, 60 which is regrowth from a cut stump and 70 is leaning over the river, will be removed as they are within the footprint of the fish bypass channel.

Amenity planting

This includes amenity planting from the 1980's along the riverbank and on internal boundaries. the species planted are Black Poplar *Populus nigra*, Lombardy Poplar *Populus nigra 'Italica',* Norway Maple *Acer platanoides*, Lime *Citrus* × *aurantiifolia* and Lawson's Cypress *Chamaecyparis lawsoniana.*

The Black Poplar are tall trees and are prominent in the landscape, There are six individual trees (27,28,29,30,49) and 84 and one group, (61) which will be retained. The tree report recommends that the individual trees would need to be reduced in height by 50% to ensure their stability when neighbouring trees are felled. Two planted Black Poplar along the riverbank (72 and 73) will be removed. The remaining Black Poplar will be retained.

There are three Lombardy Poplars, (63,65 and 66) outside the proposed footprint. While these will not be removed for the proposed works, their height and form make them unsuitable for retention in the longer term.

A total of eight Norway Maple are within the proposed footprint and will be removed during construction works– (53,55,59,77,79,80,82 and 83). Only two of these trees are in good condition, the remaining six would not be suitable for long term retention anyway due to their poor branching structure and tendency for crown branches to collapse.

There are two semi-mature Lime (54 and 58) within the proposed footprint, both would be suitable for long term retention. However, these trees will be removed during the construction works.

The six Lawson's Cypresses are growing amongst the Black Poplar and are suppressed (38 40, 42, 44, 46, 48). There are two dead trees. All are of low value and will be felled during construction works.

Naturally regenerated trees post 1900's

Naturally regenerated trees have become established along the riverbank since the 1900's. They include Alder, Ash and Sycamore all of which regenerate freely in damp, fertile conditions.

Of particular value within the riparian zone are the Alder trees (50, 64,67 and 68) which are multi-stemmed, and several are decaying. They are outside the fish bypass channel footprint and are important for biodiversity. These trees will be retained.

Elm is present in the understorey, probably regrowth from mature trees lost to the endemic elm disease in the 1980's. However this species will succumb to Dutch Elm disease as the trees mature.

Summary and Conclusions

The loss of the 1980's planted trees, Poplar, Norway Maple, lime and Lawson's Cypress will impact negatively on the landscape, but they are easily replaced by replanting with similar species, in the medium term. It is noted that these trees are not-native and their ecological value is limited.

Trees within the riparian zone, particularly the four mature Alder will be retained.

The mature Limes planted in the 1800s are a prominent landscape feature and have cultural interest. Six of the nine trees will need to be removed. These trees are not native and their ecological value is limited. It is noted that the Landscape and Visual Impact Assessment (Doyle and O'Troithigh 2022) which has been submitted with this application concluded that in the removal of these trees will have a negative, moderate, short-term effect on the landscape. However, following the implementation of the landscape plan, the impact in the long-term will be imperceptible.

6. Flora

The site of the proposed development lies within Ordnance Survey National Grid 10km square W89. The National Biodiversity Data Centre (NBDC) online database provides data on the distribution of mammals, birds, and invertebrates within the 10km grid squares (hectad).

Some 219 flowering plants are listed by the NBDC as present in the grid square W89 (NBDC 29/09/21). None of these species are designated as threatened, endangered or extinct and none are protected by the Flora Protection Order 2015 (S.I. No. 356 of 2015).

A sensitive species data request for terrestrial and aquatic flora covering the 10km grid squares adjoining and containing the proposed River Blackwater works area (i.e., W79 & W89) was requested from the Department of Culture, Heritage and the Gaeltacht on Tuesday 28th July 2020 and received on 4th August 2020. These data noted several records of the following rare/threated species; Heath Cudweed *Gnaphalium sylvaticum*, Henbane *Hyoscyamus niger*, Small Cudweed *Filago minima*, Corn Chamomile *Anthemis arvensis* and Corncockle *Agrostemma githago* within W79 and W89. None of these were recorded during site surveys.

7. Fauna

7.1 Otter

Otter is a qualifying interest for the Blackwater River (Cork/Waterford)) SAC which is one of the most important sites in Ireland for this species. Otter records were widespread throughout W79 and W89, on the River Blackwater and several tributaries (NBCD & NPWS data).

Although no records overlapped the survey area, Otter are known locally in the vicinity of Fermoy Weir (pers. obs. Ross Macklin).

An Otter survey was undertaken for the River Blackwater in the vicinity of the proposed works area (i.e., 250m upstream and 250m downstream of Fermoy Weir). Survey methodology followed the novel total channel Otter survey (TCOS) methodology as developed by Macklin *et al.* (2019). Otter signs (including spraints, prints, slides and latrines) in addition to the breeding and resting places of Otters (i.e., holts and couches) were searched for. This was undertaken along all bankside areas on foot and by boat, in addition to mid-channel gravel shoals and islands located downstream of Fermoy Bridge. Notes on the age and location (ITM coordinates) were made for each Otter sign recorded, in addition to the quantity and visible constituents of spraint (i.e., remains of fish, crayfish, molluscs etc.) (**Plate 10**).

A total of eleven Otter signs were recorded from the survey area in the vicinity of Fermoy Weir during June-July 2020 (**Figure 12**). The majority of signs were spraints although three couch sites and a holt were also recorded. The existing weir structure is evidently an important resting/feeding area for Otter, with very regular spraint sites present in addition to couch areas. The holt was located along the heavily-vegetated south bank of the River Blackwater, downstream of the weir face. The Otter holt is located approximately 300m east of the proposed development site boundary.

Plate 10. Very regular Otter sprainting site (showing abundant, White-clawed Crayfish remains) recorded on the weir face downstream of Fermoy Bridge, July 2020

Figure 12. Otter sign distribution recorded in the vicinity of the proposed works area at Fermoy Weir, July 2020.

7.2 Bats

In Ireland, nine species of bat are currently known to be resident. These are classified into two Families: the *Rhinolophidae* (Horseshoe bats) and the *Vespertilionidae* (Common bats). The Lesser Horseshoe Bat *Rhinolophus hipposideros* is the only representative of the former Family in Ireland. All the other Irish bat species are of the latter Family and these include three pipistrelle species: Common *Pipistrellus pipistrellus*, Soprano *Pipistrellus pygmaeus* and Nathusius' *Pipistrellus nathusii*, four *Myotids*: Natterer's *Myotis nattereri*, Daubenton's *Myotis daubentonii*, Whiskered *Myotis mystacinus*, Brandt's *Myotis brandtii*, the Brown Long-eared *Plecotus auritus* and Leisler's *Nyctalus leisleri* bats.

Whiskered and Natterer's bats are listed as '*Threatened in Ireland*', while the other species are listed as 'Internationally Important' in the Irish Red Data Book 2: Vertebrates (Whilde, 1993). The population status of both Whiskered and Natterer's bats was considered '*indeterminate*' because of the small numbers known of each, a few hundred and approximately a thousand respectively. Ireland is considered to be an international stronghold for Leisler's bat, whose global status is described as being at '*low risk, near threatened*' (LR; nt) by the IUCN (Hutson, *et al*., 2001).

Near threatened status is applied to those taxa that are close to being listed as vulnerable (facing a high risk of extinction in the wild in the medium-term future on the basis of a range of criteria defined by the IUCN). The Irish population of the Lesser Horseshoe Bat is estimated at 14,000 individuals and is considered of International Importance because it has declined dramatically and become extinct in many other parts of Europe. Data collected shows that the species increased significantly between from the early 1990's to present.

A review of existing bat records within W89 showed that the Irish bat species listed in **Table 4** have been recorded.

Table 4. Presence of Irish bat species within grid squares W89

Common name	Scientific name	Presence
Lesser Noctule	*Nyctalus leisleri*	Present
Pipistrelle	*Pipistrellus pipistrellus sensu lato*	Present
Soprano Pipistrelle	*Pipistrellus pygmaeus*	Present
Daubenton's Bat	*Myotis daubentonii*	Present
Natterer's Bat	*Myotis nattereri*	Present
Brown Long-eared Bat	*Plecotus auritus*	Present
Whiskered Bat	*Myotis mystacinus*	Absent
Lesser Horseshoe	*Rhinolophus hipposideros*	Absent
Nathusius's Pipistrelle	*Pipistrellus nathusii*	Absent

NBDC 29/09/21

It is noted that other species which have not been included within this database are also likely to occur. Lesser Horseshoe Bat is the only species of bat listed on Annex II of the Habitats Directive (Directive 92/43/EEC). The closest recorded records for Lesser Horseshoe Bat is approximately 38km southwest of the proposed development site at Ovens, Co. Cork (NBDC records). While the remaining Irish bat species; Nathusius' pipistrelle, Natterer's Bat and Brandt's *Myotis brandtii* bats have not been recorded in the local area to date. Nathusius' pipistrelle and Brandt's bat, are rarer Irish species, which are less likely to occur.

All bat species are protected under the Wildlife Acts (1976 & 2000) which make it an offence to wilfully interfere with or destroy the breeding or resting place of all species; however, the Acts permit limited exemptions for certain kinds of development. All species of bats in Ireland are listed in Schedule 5 of the 1976 Act and are therefore subject to the provisions of Section 23 which make it an offence to:

- Intentionally kill, injure or take a bat;
- Possess or control any live or dead specimen or anything derived from a bat;
- Wilfully interfere with any structure or place used for breeding or resting by a bat; or
- Wilfully interfere with a bat while it is occupying a structure or place which it uses for that purpose.

All bats are listed on Annex IV of the EU Habitats Directive. The domestic legislation that implements this Directive gives strict protection to individual bats and their breeding and resting places. It should also be noted that any works interfering with bats and especially their roosts, including for instance, the installation of lighting in the vicinity of the latter, may only be carried out under a licence to derogate from Regulation 23 of the Habitats Regulations 1997, (which transposed the EU Habitats Directive into Irish law) issued by NPWS. Furthermore, on 21st September 2011, the Irish Government published the European Communities (Birds and Natural Habitats) Regulations 2011 which include the protection of the Irish bat fauna and further outline derogation licensing requirements.

A study by Lundy *et al*. (2011) examined the relative importance of landscape and habitat associations across Ireland. Maximum Entropy Models (MEM) were constructed for each bat species using records from the National Bat Database from 2000-2009. This method allows species' records that have not been collected in a systematic survey to be analysed. The results help explain patterns of species' occurrence and predict where species might occur. Landcover (CORINE), topography, climate, soil pH, riparian habitat and human bias factors were incorporated into the models. The analyses provide a picture of the broad scale geographic patterns of occurrence and local roosting habitat requirements for Irish bat species. This also provides a 'habitat suitability' index. The index ranges from 0 to 100, with 0 being least favourable and 100 most favourable for bats.

The habitat indices for all Irish bats for the landscape at Fermoy is shown in **Table 5**.

Table 5. Model Predicted Habitat suitability indices for All Irish bat species

Bat species	Common Name	Habitat indices
All Bats		30.56
Pipistrellus pygmaeus	Soprano pipistrelle	43
Plecotus auritus	Brown long-eared bat	44
Pipistrellus pipistrellus	Common pipistrelle	42
Rhinolophus hipposideros	Lesser horseshoe	1

Bat species	Common Name	Habitat indices
Nyctalus leisleri	Leisler's bat	41
Myotis mystacinus	Whiskered bat	39
Myotis daubentonii	Daubenton's bat	28
Pipistrellus nathusii	Nathusius' pipistrelle	3
Myotis nattereri	Natterer's bat	34

Source: NBDC 22/10/21

In addition to domestic legislation, bats are also protected under the EU Habitats Directive (92/43/EEC) with all bat species listed in Annex IV of the Directive. The Irish government is also a signatory to the 1979 Bonn convention (Convention on the conservation of migratory species of wild animals) and the 1982 Bern convention (The convention on the conservation of European wildlife and natural habitats), and has a commitment to the 1991 Eurobats agreement (Agreement on the conservation of bats in Europe).

It is noted that sections of the development site contain a number of features of value for bats i.e., woodland, treelines and the River Blackwater channel. These provide foraging habitat and potential commuting pathways into the wider landscape for bats. Older, mature trees have the potential to provide roosting habitat. The River Blackwater is known as an important habitat for bats (NBDC). It acts as a vegetated corridor along which bats can commute from the wider countryside into the sub-urban environment. Riparian habitat along the River Blackwater also provides a sheltered foraging area, a breeding site for invertebrate prey and, at night, screening from the artificial lighting of the surrounding suburban environment.

As part of the Fermoy flood relief scheme, bat surveys were carried out in 2007 by DixonBrosnan upstream and downstream of Fermoy Bridge (*Fermoy Flood Relief Scheme – additional bat and Otter surveys 2007,* DixonBrosnan 2007). The objective of the study was to determine whether bats were roosting in either (A) old dwellings (B) mature trees within the study area. The night-time surveys were carried out using a standard heterodyne bat monitor (Batbox III) and a heterodyne/frequency division detector (Batbox duet).

During the 2007 surveys, high levels of bat activity were recorded from the River Blackwater, particularly in the vicinity of Fermoy Bridge, where Soprano Pipistrelle, Common Pipistrelle, Leislers's and Daubenton's Bat were all recorded. Bats could be seen moving though the arches of the bridge and feeding low over the water at the downstream side. Some feeding activity (Common Pipistrelle) was also detected along the vegetation/treeline along the river bank. These findings are generally in line with the findings of the EIS for the Fermoy Flood Relief Scheme (*Flood Relief Scheme Fermoy, Co. Cork, Punch & Partners*, 2005) which detected extensive bat activity along the River Blackwater. The species detected were the same during both surveys. No bat roosts were recorded during these surveys.

7.2.1 Bat Activity Survey (Bat Detector Survey)

DixonBrosnan carried out bat activity/emergence surveys upstream and downstream of Fermoy Bridge in 2021. The purpose of the survey was to assess activity levels within and in

proximity to the proposed works area, and to identify potential roosting habitat within the treelines bordering the river.

Night time bat surveys were carried out on the 30th May 2021 and 23rd of September 2021 using a Batbox Duet and Echo Meter Touch Bat Detector. The survey followed the guidelines set out in '*Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd ed)'* (Collins, 2016). The survey was carried out during suitable weather conditions for bats (air temperature of 13°C approximately, still conditions) and suitable time, starting before sunset and ending over 75 minutes after sunset.

Bat activity levels were moderate to high in May 2021 with foraging recorded by four species. The most common species were Soprano Pipistrelle and Common Pipistrelle with extensive foraging activity along riparian treelines and riverine habitat within the study area. Leisler's Bat were less common. Daubenton's Bat was recorded foraging over the river (one individual). No emergence of bats from trees or the bridge was recorded.

Lower levels of bat activity were recorded during the survey in September 2021. Common Pipistrelle, Soprano Pipistrelle and Leisler's Bat were recorded foraging upstream and downstream of the bridge. No evidence of roosting was recorded and it appears that the treelines are used primarily for feeding and navigation. One Brown Long-eared Bat was detected in proximity to the bridge.

Common Pipistrelle are crevice dwellers. They use many features on and in a building but relatively rarely enter the roof void. Features used in summer include soffits, fascia's, barge-boards, weather boarding, between roof felt/membrane and tiles/slates, around window frames, in cavity walls, under hanging tiles and lead flashing. In winter, pipistrelle species may use cavity walls or crevices deep in solid walls.

Soprano Pipistrelle is a habitat generalist although it tends to occur more often in the vicinity of broadleaved woodland. Lintott *et al.* (2014) found that in female soprano pipistrelles typically exploit woodlands which are well connected, with lower clutter, more mature trees and a lower edge to interior ratio. Habitat quality and the composition of the surrounding landscape appears to be less limiting to males (Lintott et al. 2014). Although generally found roosting in buildings the Soprano pipistrelle also roosts in tree holes and crevices. Summer roosts support colonies of an average size of 200 bats, however this number is probably considerably less when roosting within trees.

Leisler's bats forage in a variety of habitats including over pasture, rivers, lakes, canals, forestry and around streetlights/flood lights, but they prefer open habitats and rivers or lakes (Vaughan et al., 1997). Maternity colonies form in late spring/early summer, mainly in buildings but also occasionally in hollow trees. Hibernation records are scarce but most are from hollows and crevices in trees.

Brown Long-eared Bat prefers to forage in parkland, open deciduous and coniferous woodland, orchards and gardens but it is slow to leave its roost and it is often fully dark before it emerges 50 to 60 minutes after sunset. As its prey are available throughout the night on foliage it need not hurry out as the hawking bat species do to take advantage of the increased activity of insects at dusk. Also, being a slow flier, it may also be avoiding falling prey to predators such as sparrowhawk. The Brown Long-eared Bat feeds throughout the night. Brown Long-eared Bats have a liking for large roof spaces as they prefer to fly within the

building, for some minutes, before emerging for the night's foraging. They are frequently found in older buildings, in lofts, barns, stables etc. Usually, they cluster along the ridge beam or next to a chimney. The species also makes use of trees as summer roosts and colonise bat boxes readily.

Daubenton's Bat feeds close to the surface of water, either over rivers, canals, ponds, lakes or reservoirs, but can also be found foraging in woodlands. Flying at 15km per hour, it gaffs insects with its over-sized feet as they emerge from the surface of the water – feeding on caddis flies, moths, mosquitoes, midges etc. It is often found roosting beneath bridges or in tunnels and also makes use of hollows in trees.

Bat foraging was largely confined to the River Blackwater channel and associated riparian zone which provides the highest value resource within the proposed development site, with large numbers of macro-invertebrate prey and sheltered conditions. Bats were recorded along the length of the survey area with abundance and species linked to flow conditions, bankside vegetation and levels of external lighting. Overall, the Blackwater River and its riparian zone within the study area is considered of high value at a local level for bats.

7.2.2 Roost survey

It is noted that there are no buildings within the proposed development site. A detailed survey of trees within and in proximity to the proposed development site was carried out (**Appendix 4** *Tree Survey and Arboricultural Impact Assessment Fermoy Weir Development, Co. Cork. Mark Donnelly, 2021*). The survey recorded a number of trees species including Black Poplar, Lawson's Cypress, Lime, Norway Maple, Ash, Lombardy Poplar, Alder and Sycamore. Trees were broadly classified into three groups namely,

1. Parkland planting- early 1800's,
2. Amenity planting 1980's
3. Naturally regenerated trees, post 1900.

It is noted that many of the trees within the works area are non-native and bats are most likely to use old trees which have certain structural elements (i.e. cracks, crevices, rotten areas etc) as roosts. There are a number of mature trees within the study area which have these structural elements and are of sufficient age to provide bat roosts including a small number of native trees such as mature Alder.

Overall, the trees earmarked for removal are classified as low to moderate value as Potential Roost Features (PRF) (Collins 2016). Bat surveys did not detect bats emerging from trees within the study area, however it is noted that small numbers of bats using mature trees can be difficult to detect and roosts in trees are often temporary. Whilst the presence of significant bat roosts within any of the trees to be removed is considered unlikely, the presence of individual or small numbers of roosting bats within trees to be removed cannot be altogether excluded. Therefore, mitigation measures will be implemented to minimise any potential impacts on bats.

7.3 Other Terrestrial Mammals

Fourteen other species of terrestrial mammal have been recorded within grid square W89, six of which are protected under the Irish Wildlife Act; namely Badger *Meles meles*, Pygmy Shrew *Sorex minutus*, Red Squirrel *Sciurus vulgaris*, Hedgehog *Erinaceus europaeus*, Fallow Deer *Dama dama* and Irish Hare *Lepus timidus subsp. Hibernicus*.

7.3.1 Badger

Badger and their setts are protected under the provisions of the Wildlife Act 1976, as amended, and it is an offence to intentionally, knowingly or unknowingly kill or injure a protected species, or to wilfully interfere with or destroy the breeding site or resting place of a protected wild animal. This species has been recorded 45 times in W89, with the most recent record in December 2016. Badgers are known to occur within the wider landscape (NBDC), however no signs of Badger, were recorded during the site surveys. The proposed development site is of negligible value for Badger.

7.3.2 Pygmy Shrew

Pygmy Shrew is common throughout mainland Ireland and prefers habitats such as hedgerows and grasslands; they have also been found utilizing stone walls. There are two records of Pygmy Shrew in W89, the most recent from June 2013. Due to the habitats present within the proposed site Pygmy Shrew are likely to be present. The proposed development site is of local value (lower importance) for Pygmy Shrew.

7.3.3 Red Squirrel

Red Squirrel is listed on Appendix III of the Berne Convention can be found throughout Ireland. There are ten records of Red Squirrel in the 10km grid square W89, the most recent from September 2017. Red Squirrel may occur within the proposed development site and this site is of local value (lower importance) for Red Squirrel.

7.3.4 Hedgehog

Hedgehog is protected under the Wildlife Act and is also listed on Appendix III of the Berne Convention. Hedgehogs can be found throughout Ireland, with male Hedgehogs having an annual range of around 56 hectares. This species has been recorded two times on W89, the most recent record in November 2020. Due to the habitats recorded within the site, Hedgehog is likely to occur within the proposed development site and this site is of local value (lower importance) for Hedgehog.

7.3.5 Irish Hare

Irish Hare is one of three lagomorphs found on the Island of Ireland and the only native lagomorph. It is listed on Appendix III of the Berne Convention, Annex V(a) of the EC Habitats Directive (92/43/EEC) and as an internationally important species in the Irish Red Data Book.

The Irish hare is adaptable and lives in a wide variety of habitats. It typically reaches its highest densities on farmland, particularly where there is a mix of grassland and arable fields along with hedgerows and other cover. According to the NBDC, hares have been recorded in W89

on one occasion, in March 1990. No signs of Hare were recorded at the proposed development site. The site is of negligible value for Irish Hare.

7.3.6 Fallow Deer

Fallow Deer are Ireland's second largest deer species and are the most widespread of the deer, found in nearly every county of the island. Fallow Deer are classified as grazers or non-selective bulk feeders, although they will browse on trees and shrubs. The species has become almost nocturnal in their grazing habits in areas of high disturbance. This species has been recorded on one occasion in grid square W89, in December 2008. No signs of Fallow Deer were recorded at the proposed development site and there are no habitats of particular value onsite. The site is of negligible value for Fallow Deer.

7.4 Reptiles and Amphibians

According to records held by the NBDC, Common Frog (*Rana temporaria*) is the only amphibian species recorded within grid square W89 (Source: NBDC 29/09/21). Common Frog is listed in Annex V of the EU Habitats Directive and is protected under the Wildlife Acts. The species was not recorded during the site survey and no suitable habitats for this species was recorded. There are no records of reptile species within W89 and the habitats onsite, this is site are of negligible value for reptiles.

7.5 Birds

The National Biodiversity Centre online data base lists 92 bird species in W89. Of these species, a number are listed under Annex I of the Birds Directive i.e Common Kingfisher *Alcedo atthis,* Corn Crake *Crex crex*, Little Egret *Egretta garzetta*, Peregrine *Falcon Falco peregrinus*, Short-eared Owl *Asio flammeus*, Whooper Swan *Cygnus cygnus* and Golden Plover *Pluvialis apricaria*.

Bird surveys for general bird usage were carried out in conjunction with habitat surveys within the entire development footprint on the 28th May 2021 and 19th of July 2021 and additional observations on other survey dates were recorded where relevant. A search of the riverbanks in the vicinity of the proposed development site was also carried out to determine if any Kingfisher nests or nesting habitat was present. Kingfishers are known to occur in this general area (Carl Dixon pers. observation).

Bird species listed in Annex I of the Birds Directive are considered a conservation priority. Certain bird species are listed by BirdWatch Ireland as Birds of Conservation Concern in Ireland (BOCCI). These are bird species suffering declines in population size. BirdWatch Ireland and the Royal Society for the Protection of Birds have identified and classified these species by the rate of decline into Red and Amber lists. Red List bird species are of high conservation concern and the Amber List species are of medium conservation (Gilbert *et al.* 2021). Green listed species are regularly occurring bird species whose conservation status is currently considered favourable. Bird species listed in Annex I of the Birds Directive (2009/147/EC) are considered a conservation priority. Species recorded within the proposed development footprint which were recorded during habitat surveys are shown in **Table 6**. **Table** 6. Bird Species recorded during site surveys

Table 6. Bird Species recorded during site surveys

Species		Birds Directive Annex	BOCCI	
		I	Red List	Amber List
Blackbird	*Tardus merula*			
Blue Tit	*Cyanistes caeruleus*			
Chaffinch	*Fringilla coelebs*			
Dunnock	*Prunella modularis*			
Goldcrest	*Regulus regulus*			X
Goldfinch	*Carduelis carduelis*			
Great Tit	*Parus major*			
Grey Heron	*Ardea cinerea*			
Grey Wagtail	*Motacilla cinerea*		X	
Hooded Crow	*Corvus cornix*			
Jackdaw	*Corvus monedula*			
Lesser Black-Backed Gull	*Larus fuscus*			x
Little Egret	*Egretta garzetta*	x		
Magpie	*Pica pica*			
Mallard	*Anas platyrhynchos*			X
Mute Swan	*Cygnus olor*			X
Pied Wagtail	*Motacilc alba*			
Robin	*Erithacus rubecula.*			
Rook	*Corvux frugiligus*			
Swallow	*Hirundo rustica*			X
Woodpigeon	*Columba palumbus*			
Wren	*Troglodytes troglodytes*			

Generally, the mix of riparian vegetation, parkland/grassland and freshwater habitat supports a relatively diverse mix of bird species. One Red List species were recorded i.e. Grey Wagtail as well as a number of Amber List species i.e. Mallard *Anas platyrhynchos*, Mute Swan *Cygnus olor* Lesser Black-Backed Gull *Larus fuscus,* Goldcrest *Regulus regulus* and Swallow *Hirundo rustica*. The Annex I species, Little Egret *Egretta garzetta* was also recorded at the site.

The River Blackwater has the potential to provide additional habitat for more specialised species such as Kingfisher *Alcedo atthis*. However, no signs of this Annex I species were

recorded during the site surveys. Kingfisher is listed on Annex I of the EU Birds Directive and Appendix II of the Bern Convention. The species is Amber-listed in Ireland and BirdLife International has evaluated the European population as depleted, due to a moderate historical decline. Kingfishers prefer still or gently flowing water with plenty of small fish, and with reeds, rushes or shrubs on the banks for perches. Streams, small rivers, canals and ditches are favoured to open waterbodies, but it also uses lakes, ponds and flooded gravel pits. Egg-laying occurs from March to July. Suitable banks for nesting are required in breeding season, but nest-sites can be over 250m from foraging waters and can occur infrequently in walls, rotten tree stumps, concrete tunnels in canal banks, or in the burrow of Sand Martin (*Riparia riparia*). Suitable Kingfisher nesting banks are generally tall vertical banks with soft material into which they can dig their burrows.

The size of a Kingfisher territory depends on the amount of food available, and on the bird population in the area. Territories tend to cover at least 1km of river, but may extend over 3/5 km. Any nearby waterbody that provides good fishing will be included in the territory. Kingfishers may be found along streams of all kinds, lakes and ponds and tend to be more coastal in winter, where they may be seen in estuaries, rocky seashores and harbours.

Breeding Kingfisher has been recorded in proximity to the study area (NBDC). However, no Kingfisher nesting sites were recorded by DixonBrosnan within the proposed study area. It is noted that this section of the River Blackwater was not included in the survey area of the National Kingfisher Survey (Birdwatch Ireland 2010), but probable nest sites were recorded upstream and downstream of the site. The riverbanks bordering the proposed development site are either manmade (along the southern banks) or too low (along northern banks) to provide nesting sites for Kingfisher. However, the overhanging vegetation on the northern riverbanks and the instream vegetation particularly downstream of Fermoy Bridge provides potential foraging habitat for Kingfisher.

Overall, the proposed development site supports a mix of bird species which are common and widespread within the county. A number of Red and Amber listed were recorded within the study area. The River Blackwater at the site supports some more specialist species including Little Egret, Grey Heron *Ardea cinerea*, Mallard, Mute Swan and Grey Wagtail and is considered an important local resources for birds. The proposed development site is of Local importance (Higher value) for birds.

7.6. Invasive Species

Non-native plants are defined as those plants which have been introduced outside of their native range by humans and their activities, either purposefully or accidentally. Invasive non-native species are so-called as they typically display one or more of the following characteristics or features: (1) prolific reproduction through seed dispersal and/or re-growth from plant fragments; (2) rapid growth patterns; and, (3) resistance to standard weed control methods.

Where a non-native species displays invasive qualities and is not managed it can potentially: (1) out compete native vegetation, affecting plant community structure and habitat for wildlife; (2) cause damage to infrastructure including road carriageways, footpaths, walls and foundations; and, (3) have an adverse effect on landscape quality. The NBDC lists a number

of both aquatic and terrestrial high impact invasive species which have been recorded within grid square W89 (**Table 7**).

Table 7. High impact invasive species recorded in W89

Species group	Species name
flowering plant	Canadian Waterweed (*Elodea canadensis*)
flowering plant	Cherry Laurel (*Prunus laurocerasus*)
flowering plant	Giant Hogweed (*Heracleum mantegazzianum*)
flowering plant	Indian Balsam (*Impatiens glandulifera*)
flowering plant	Japanese Knotweed (*Fallopia japonica*)
flowering plant	*Rhododendron ponticum*
terrestrial mammal	American Mink (*Mustela vison*)
terrestrial mammal	Brown Rat (*Rattus norvegicus)*
terrestrial mammal	Eastern Grey Squirrel (*Sciurus carolinensis*)
terrestrial mammal	Fallow Deer (*Dama dama*)
terrestrial mammal	Feral Ferret (*Mustela furo*)

Source NBDC: 28/10/21

The control of invasive species in Ireland comes under the Wildlife (Amendment) Act 2000, where it states that

'Any person who— [...] plants or otherwise causes to grow in a wild state in any place in the State any species of flora, or the flowers, roots, seeds or spores of flora, ['refers only to exotic species thereof'][...] otherwise than under and in accordance with a licence granted in that behalf by the Minister shall be guilty of an offence.'

The Birds and Natural Habitats Regulations 2011 (SI 477 of 2011), Section 49(2) prohibits the introduction and dispersal of species listed in the Third Schedule, which includes Japanese Knotweed *Fallopia japonica* and Himalayan Balsam *Impatiens glandulifera*, as follows: "any person who plants, disperses, allows or causes to disperse, spreads or otherwise causes to grow [….] shall be guilty of an offence." Himalayan Balsam both juvenile and adult plants, is widely scattered throughout the riparian zone. One area of Japanese Knotweed was recorded on the southern banks of the proposed development site (**Figure 13**).

Japanese knotweed is a highly invasive, non-native species which was originally introduced as an ornamental plant but has since spread along transport routes and rivers to become a serious problem. From an ecological viewpoint it out-competes native species by forming dense stands which suppresses growth of other species. It grows extremely vigorously and can penetrate through small faults in tarmac and concrete and thus can damage footpaths, roads and flood defence structures. As it can survive in poor quality soils, including spoil, it often thrives in brownfield sites and in urban areas.

Himalayan balsam is an invasive terrestrial plant species that was first introduced in the UK in 1839 as an ornamental garden plant. Since it was introduced, it has spread to most parts of

Ireland. Due to the nutrient poor soil and cold temperatures in its home range, the Himalayas, it has adapted to develop thousands of seeds, which are dispersed widely as the ripe seedpods shoot their seeds up to 7m (22ft) away. Due to our warmer climate and nutrient rich soils, it has thrived here and became highly invasive. Once established in the catchment of a river the seeds, which can remain viable for two years, are transported further afield by water.

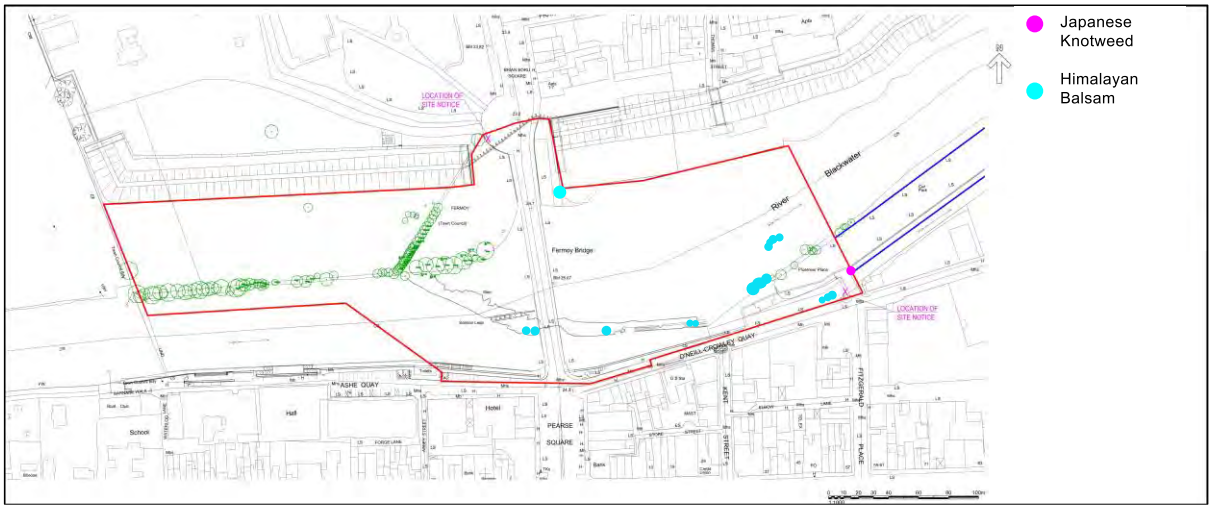

Figure 13. Location of invasive species proposed development site

It is noted the invasive fish species Dace (*Leuciscus leuciscus*) was recorded during electrofishing surveys within the proposed development site both upstream and downstream of the existing weir (See **Section 7.7.1** for detail). Dace is a relatively small cyprinid fish with a dorso-ventrally flattened symmetry, which makes it suited to fast flowing water. The flanks are silver, darkening to a bluish green along the back. Dace were intentionally released in the River Blackwater by anglers as live bait in 1889.

The most pressing of the threats posed by Dace is the impact on native salmonids. Dace, trout and salmon have similar habitat preferences and all spawn over gravels in fast flowing water. Dace competes with salmon for breeding grounds (O'Grady. in Caffrey *et al.,* 2007), as well as potentially impacting on populations through predation (King *et al.* 2009). Efforts to create and improve breeding grounds for salmonids in the River Blackwater have been hampered by Dace moving onto the newly introduced gravels at spawning times.

7.7 Fish

7.7.1 Electrofishing Survey

Triturus Environmental Ltd. made an application under Section 14 of the Fisheries (Consolidation) Act, 1959 as substituted by Section 4 of the Fisheries (Amendment) Act, 1962, to undertake an electro-fishing survey (n=5 sites; see **Table 8, Figure 9**) in the footprint of the proposed Fermoy Weir works. Further details on the survey are included in **Appendix 2** of this report.

A single anode Smith-Root LR24 backpack (12V DC input; 300V, 100W DC output) was used to electro-fish sites on the River Blackwater in the footprint of the proposed Fermoy Weir works on 9th July 2020. Both river and holding tank water temperature was monitored continually throughout the survey to ensure temperatures of 20°C were not exceeded, thus minimising

stress to the captured fish due to low dissolved oxygen levels. Electro-fishing methodology followed accepted European standards (CEN, 2003) and adhered to best practice (e.g. CFB, 2008).

Table 8. n=5 electro-fishing survey site locations on the River Blackwater in the vicinity of Fermoy Weir, Co. Cork.

Site no.	Watercourse	EPA code	Location	X (ITM)	Y (ITM)
E1	River Blackwater	18B02	Upstream of Fermoy Weir – along weir face	581079	598606
E2	River Blackwater	18B02	Upstream of Fermoy Weir – along weir face	581118	598589
E3	River Blackwater	18B02	Downstream of Fermoy Weir – north bank channel	581189	598657
E4	River Blackwater	18B02	Downstream of Fermoy Weir – centre arch	581167	598609
E5	River Blackwater	18B02	Downstream of Fermoy Weir – downstream of weir pool	581248	598632

Section A was too deep to electro-fish utilising backpack equipment (mostly >2m) and, therefore, no results were available. However, in terms of fisheries habitat, the deep glide habitat of section A offered good salmonid holding habitat, with nursery and spawning habitat much improved downstream of the weir. The river upstream of the weir offered very good European Eel (*Anguilla anguilla*) habitat given the presence of deep water and frequent boulder/cobble refugia. Observably, the section also supported a large population of non-native Dace, non-native Roach (*Rutilus rutilus*) and other species such as Minnow (*Phoxinus phoxinus*). Lamprey habitat was poor given the high average depth, slower flow and bedded substrata, resulting in a general lack of suitable sediment accumulations for ammocoetes and poor spawning habitat.

Electro-fishing was undertaken at one site within survey section B i.e. E1 (**Figure 9**). A total of *n*=4 fish species were recorded. Atlantic salmon (*Salmo salar*) and Brown Trout (*Salmo trutta*) dominated, with low numbers of European Eel and Dace captured.

Electro-fishing was undertaken at three sites (E2, E3 and E4) within survey section C (**Figure 9**). A total of *n*=10 fish species were recorded across the three sites (i.e. Atlantic salmon, Brown Trout, Minnow, Roach, Dace, European Eel, Three-spined Stickleback (*Gasterosteus aculeatus*), Gudgeon (*Gobio gobio*), Stone Loach (*Barbatula barbatula*) and *Lampetra* sp.). Three discrete 2m^2 areas (i.e. A, B & C) in the vicinity of mid-channel islands were targeted for lamprey ammocoetes (i.e. site E5**, Figure 9**). All of these areas supported *Lampetra* sp. ammocoetes, with equivalent densities of 10.5, 12 and 15 ammocoetes per m^2 recorded, respectively. Section C offered some excellent salmonid nursery habitat, with some locally excellent spawning substrata and holding habitat present also. European Eel habitat was good overall.

Electro-fishing was undertaken at one (E5) within survey section D (**Figure 9**). A total of *n*=3 fish species were recorded, with low numbers of Dace, Stone Loach and Three-spined Stickleback present. Section D offered excellent salmonid habitat overall, with high-quality spawning, nursery and holding habitat present. Lamprey spawning habitat was also present (including for Sea Lamprey) with some good European Eel habitat associated with deeper pool areas.

Electro-fishing was not undertaken in section E. Due to poor connectivity with the main river, the survey reaches of the channel were of little fisheries value apart from for European eel. However, fisheries value improved considerably in the downstream reaches, where some good value as a coarse fish nursery was present.

7.7.1 Twaite Shad

Given limited knowledge on the known distribution and range of qualifying interest Twaite Shad within the River Blackwater, environmental DNA (eDNA) analysis was undertaken on water samples collected on the 21st May 2020 (**Appendix 2 Table 2.2**). Sample collection overlapped with the seasonal migration of anadromous twaite shad into Irish rivers and coincided with the known peak spawning period of the species (King & Linnane, 2004; Doherty *et al.*, 2004). Analysis sought to elucidate the longitudinal distribution of shad species (*Alosa* spp.) within the River Blackwater, clarifying whether or not shad species could access and utilise the Fermoy Weir area. As Twaite Shad and the closely-related Allis Shad (*Alosa alosa*) readily hybridise, it is not feasible to use eDNA assays (which are based on mitochondrial DNA) to speciate shad. Thus, analysis could only determine the presence or absence of *Alosa* species (i.e., Twaite Shad and Allis Shad). The presence of shad species DNA in a given sample specified their presence at that location during the sampling period. A negative result indicated the species was present at undetectable densities or not present at the time of sampling. Sampling locations are shown in **Figure 15** and further details on survey methodology is included in **Appendix 2**.

Shad (*Alosa* spp.) eDNA was detected from water samples collected from the 'Kitchen Hole' site on the River Blackwater at Cappoquin. However, no detectable concentrations of shad eDNA were recorded in water samples taken on the same day upstream of Fermoy Weir (samples 1A, 1B, 1C), downstream of Fermoy Weir (2A, 2B, 2C) or downstream of Clondulane Weir (3A, 3B, 3C) on the River Blackwater. This indicated the absence of *Alosa* spp. from these locations during the peak spawning migration sampling period (**Figure 14**). The positive control samples from St. Mullin's on the River Barrow (sites 5A, 5B & 5C) all contained Alosa spp. DNA (**Figure 14**). All samples from all sampling locations yielded detectable Brown Trout (*Salmo trutta*) eDNA qPCR reactions (data not shown), demonstrating that all samples contained DNA that could be amplified successfully.

The concentrations of eDNA ranged from the lowest of 0.054ng/L in sample 5A at St. Mullin's to the highest of 1.442ng/L in the 4C sample from Kitchen Hole, Cappoquin. Average eDNA concentrations (across biological replicates) ranged from the lowest at in St. Mullin's (0.233 ng/L ±SD 0.152) to the highest at Kitchen Hole, Cappoquin (1.351, ±SD 0.079) ng/L). There was a significantly higher concentration of Alosa spp. eDNA in the Munster Blackwater (Kitchen Hole, Cappoquin) than in the samples from River Barrow (St. Mullin's) (**Figure 14**).

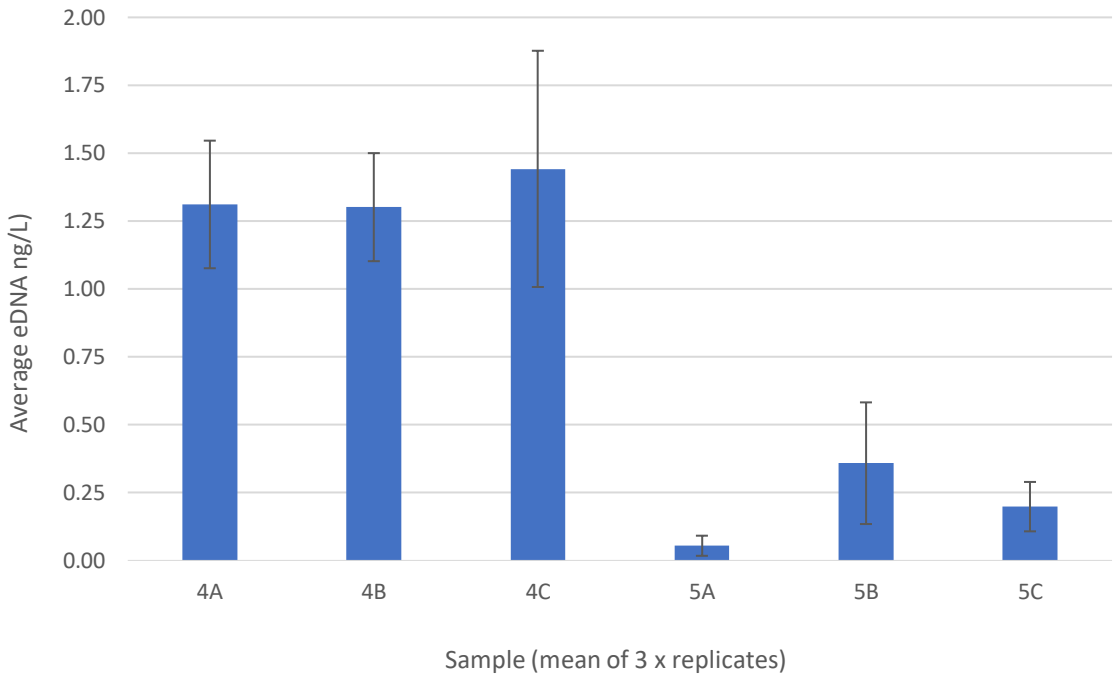

Figure 14. Average eDNA concentrations (ng/l) ±SD of Alosa spp. eDNA recorded in water samples from 'Kitchen Hole', River Blackwater and control site at St. Mullin's, River Barrow, May 2020

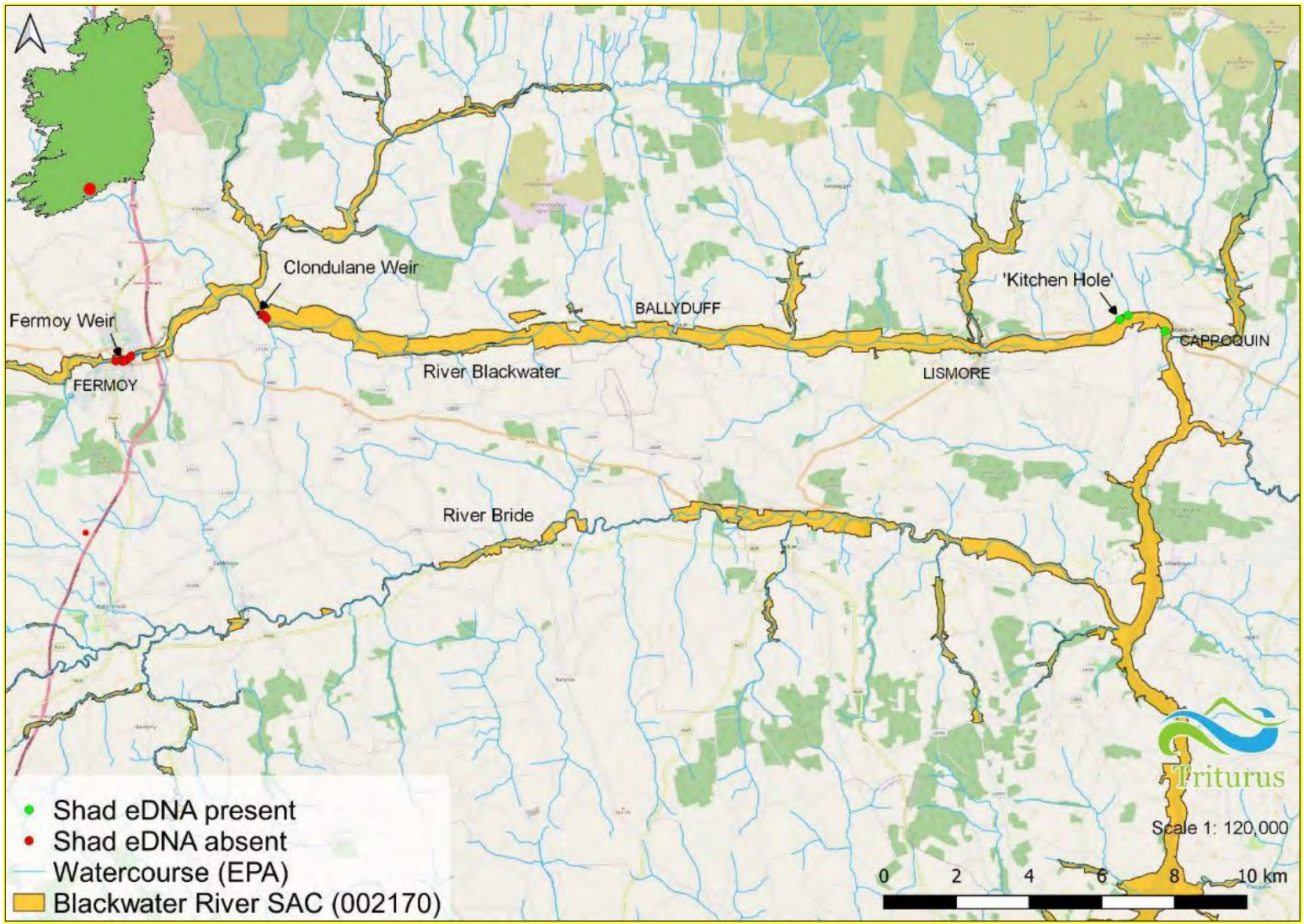

Figure 15. Shad species (Alosa spp.) eDNA presence/absence in the River Blackwater samples, May 2020 (River Barrow positive control site not shown)

7.8 Other species listed by NBDC as present within grid square W79 and W89

7.8.1 Bryophytes

The National Parks and Wildlife Service (NPWS) rare plant database shows no records of protected bryophyte species in the vicinity of the proposed development site (NPWS 29/09/21).

As part of the aquatic habitat assessment, aquatic bryophytes and their percentage coverage of the riverbed at the sampling sites was recorded. Instream bryophytes were limited to occasional *Fontinalis antipyretica* on larger boulders in Section A of the survey area. The existing weir structure within Section A supported sparse growth of aquatic mosses *Cinclidotus fontinaloides* and *Fontinalis antipyretica* on the wetted faces.

In Section C, *Fontinalis antipyretica* was recorded very locally on large cobble. *Cinclidotus fontinaloides* was very abundant along the dry weir faces.

No other bryophytes were recorded within the proposed development site.

7.8.2 Invertebrates

There are numerous records for Freshwater Pearl Mussel within the River Blackwater main channel. Whilst most records were for the river in the vicinity of Ballyhooly (upstream of Fermoy), two historical records were available for the Blackwater upstream (1917) and downstream (1987) of Fermoy town, respectively (NPWS data). Four live mussels were recorded at Fermoy Weir in 2011, but these are no longer present. A low number of records for White-clawed Crayfish were available for the River Blackwater near Ballyhooly (W79) but none overlapped with the proposed development site (NBDC & NPWS data).

Surveys for Freshwater Pearl Mussel and White-clawed Crayfish were carried out at the proposed development site. Further details on this survey methodology and results are included in **Appendix 2** and **Appendix 3**.

In Section A Freshwater Pearl Mussel habitat was poor, given bedded substrata, seasonally low flows and evident siltation/enrichment. None were recorded present in this area. White Clawed Crayfish habitat was of moderate quality with suitability mainly in the channel margins under boulder and large woody debris. However, only very low densities were recorded.

In Section B White Clawed Crayfish habitat was of moderate quality, particularly in the vicinity of the weir structure where low densities were recorded. Freshwater Pearl Mussel habitat was poor given bedded substrata, seasonally low flows and evident siltation/enrichment. None were recorded present.

White-clawed Crayfish habitat was good in the vicinity of Fermoy Bridge (particularly the northern half of the river) with moderate densities of juvenile and adult crayfish were recorded via sweep netting and snorkelling during the site visit. Despite some improved suitability compared to upstream areas, no Freshwater Pearl Mussel were recorded present in section C. Pearl mussel habitat was sub-optimal given seasonally low flows and evident siltation/enrichment.

Good-quality White-clawed Crayfish habitat was limited to the vicinity of the weir face and associated deep pool. Low numbers were recorded via sweep netting along the weir face adjoining this pool. Despite some improved suitability compared to upstream areas, no Freshwater Pearl Mussel were recorded present in section D. Pearl mussel habitat was sub-optimal given seasonally low flows and evident siltation/enrichment.

8. Water Quality

8.1 EPA Water Quality Data

Water quality is a key supporting feature for aquatic qualifying interests for the Blackwater River (Cork/Waterford) SAC and therefore any impacts on water quality have the potential to negatively impact on these species and habitats.

The Environmental Protection Agency carries out a biological assessment of most river channels in the country on a regular basis. The assessments are used to derive Q values, indicators of the biological quality of the water. The biological health of a watercourse provides an indication of long-term water quality. The EPA Q value scheme is summarised in **Table 9**. The relationship between the Q-rating system and the Water Framework Directive classification as defined by the Surface Waters Regulations 2009 (S.I. 272 of 2009) is shown in **Table 10**.

The Q Value system which is used by the Environmental Protection Agency describes the relationship between water quality and the macro-invertebrate community in numerical terms. The presence of pollution causes changes in flora and fauna of rivers. Well documented changes occur in the macro-invertebrate community in the presence of organic pollution: sensitive species are progressively replaced by more tolerant forms as pollution increases. Q5 waters have a high diversity of macro-invertebrates and good water quality, while Q1 have little or no macro-invertebrate diversity and unsatisfactory water quality.

The intermediate ratings Q1-2, Q2-3, Q3-4 and Q4-5 are used to denote transitional conditions, while ratings within parenthesis indicate borderline values. Great importance is attached to the EPA biotic indices, and consequently it is these data that are generally used to form the basis of water quality management plans for river catchments. EPA biological monitoring data for the closest sites, for which up to date data is available, on the River Blackwater is shown in **Table 11** and **Figure 16.**

Table 9. EPA biotic index scheme.

Q value	Water quality	Pollution	Condition
5	Good	Unpolluted	Satisfactory
4	Fair	Unpolluted	Satisfactory
3	Doubtful	Moderately polluted	Unsatisfactory
2	Poor	Seriously polluted	Unsatisfactory
1	Bad	Seriously polluted	Unsatisfactory

Source: EPA

Table 10. Correlation between the WFD classification and Q values

Ecological status WFD	Q Values
High	Q5, Q4-5
Good	Q4
Moderate	Q3-4
Poor	Q3, Q2-3
Bad	Q2, Q1

Figure 16. Location of EPA Q values.

Table 11. Q-values and survey locations.

Q-Value location	Distance from development (as the crow flies)	Q-Value (Most recent)
Munster Blackwater		
Ballyhooley Br	9.2 km upstream	Q4(Fair Status – 2020)
Fermoy Bridge LHS	Adjacent	Q4(Fair Status – 2015)
Fermoy Bridge RHS	Adjacent	Q4(Fair Status – 2020)
W of Kilmurry Ho	7.8km downstream	Q4 (Fair Status – 2018)

Source: EPA Envision map system

8.2 River Basin Management Plan for Ireland 2018 – 2021 (2nd Cycle)

The Water Framework Directive (WFD) sets out the environmental objectives which are required to be met through the process of river basin planning and implementation of those

plans. Specific objectives are set out for surface water, groundwater and protected areas. The challenges that must be overcome in order to achieve those objectives are significant. Therefore, a key purpose of the River Basin Management Plan (RBMP) is to set out priorities and ensure that implementation is guided by these priorities.

The second cycle RBMP aims to build on the progress made during the first cycle. Key measures during the first cycle included the licensing of urban waste-water discharges (with an associated investment in urban waste-water treatment) and the implementation of the Nitrates Action Programme (Good Agricultural Practice Regulations). The former measure has resulted in significant progress in terms both of compliance levels and of the impact of urban wastewater on water quality. The latter provides a considerable environmental baseline which all Irish farmers must achieve and has resulted in improving trends in the level of nitrates and phosphates in rivers and groundwater. It is acknowledged, however, that sufficient progress has not been made in developing and implementing supporting measures during the first cycle.

Overall, RBMP assesses the quality of water in Ireland and presents detailed scientific characterisation of our water bodies. The characterisation process also takes into account wider water quality considerations, such as the special water-quality requirements of protected areas. The characterisation process identifies those water bodies that are At Risk of not meeting the objectives of the WFD, and the process also identifies the significant pressures causing this risk. Based on an assessment of risk and pressures, a programme of measures has been developed to address the identified pressures and work towards achieving the required objectives for water quality and protected areas. Data relating to the watercourses within the study area is provided in **Table 12** and shown in **Figure 17**. Limited data on the 3rd cycle of the RBMP have been released through the EPA envision mapping website and these are also reported below where relevant.

Table 12. Water Framework Directive Data – Relevant data

Catchment: Blackwater (Munster) (Code 18) – 2nd Cycle
This catchment includes the area drained by the River Blackwater and all streams entering tidal water between East Point and Knockaverry, Youghal, Co. Cork, draining a total area of 3,310km². The largest urban centre in the catchment is Mallow. The other main urban centres in this catchment are Fermoy, Mitchelstown, Youghal, Kanturk and Millstreet. The total population of the catchment is approximately 109,030 with a population density of 33 people per km². The Blackwater rises on the southern side of Knockanefune in the Mullaghareirk Mountains and flows south to Rathmore where it is joined by the Cullavaw River and the Owentaraglin River. The Blackwater continues eastwards to Banteer where it is joined by the Allow River from the north and the Glen River from the south. On its route east, the Blackwater is joined by the Awbeg, and the Cyldagh River before flowing through Mallow and eastwards to Fermoy. Downstream of Fermoy, the river is joined by its tributaries, the Rivers Funsion, Ariglin and Owennashad. The Blackwater becomes tidal, before turning abruptly south at Cappoquin where the Glennafilla River joins from the northeast. The tidal Blackwater is joined by the Finisk River and the Bride River from the west downstream of Villerstown. The Goish, Licky, Glendine and Tourig Rivers drain the lands adjacent to the estuarine part of the catchment, and the Blackwater then flows past Youghal and out to sea through Youghal Harbour. The Munster Blackwater catchment comprises 28 subcatchments with 158 river water bodies, no lakes, three transitional and one coastal water body, and 18 groundwater bodies. There are no heavily modified or artificial water bodies in the Munster Blackwater Catchment.

Catchment: Blackwater (Munster) (Code 18) – 2nd Cycle

There are three designated Nutrient Sensitive Areas (NSAs) (Blackwater (River), Blackwater Estuary Upper and Blackwater Estuary Lower) associated with three waste water treatment plants (Mallow, Fermoy and Youghal).

Two of the three urban wastewater treatment plants (Mallow and Fermoy) have tertiary treatment and, therefore, were compliant with the environmental objectives for NSAs.

Youghal urban wastewater treatment was not compliant with the environmental objective for NSAs in 2015. Works are currently underway to provide secondary treatment at the plant.

Waterbodies At Risk

Fifty-two river water bodies in the catchment are At Risk of not meeting their water quality objectives. There are 15 river water bodies in Review (this means that either more information is required, or Good ecological status was recorded in 2010-2015, but nutrient concentrations are elevated).

Alteration of hydro-morphological (or physical) conditions is one of the most significant issues in rivers in the Munster Blackwater Catchment. This includes inputs of excess fine sediment and alteration of the morphology of the river channel, which in turn alter habitat conditions. This can occur because of, for example, implementing river and field drainage schemes, forestry activities, animal access, and discharge from quarries.

Excess phosphate leading to eutrophication is also a significant issue of concern in several water Bodies.

Urban Wastewater Treatment Plants (WWTPs) and agglomeration networks have been identified as a significant pressure in 13 At Risk water bodies within the catchment. None of these is relevant to the proposed development being assessed.

Sub catchment data

The proposed development falls close to the eastern boundary of Sub catchment Blackwater [Munster]_SC_110. The issues on the main channel occur in the westerly part of the sub catchment and range from elevated nutrients due to a combination of point (Section 4 and licenced facility) and urban diffuse sources on Blackwater (Munster)_130 to unknown pressures driving moderate fish status on Blackwater (Munster)_160. On a tributary to the Blackwater, Ross Killavulleen_010, ecological status declined to Moderate and the significant pressures are a combination of hydromorphology, forestry and nutrients from an urban wastewater treatment plant.

Waterbodies prioritised for Action

Following the publication of the draft river basin management plan in early 2017, the EPA and the Local Authority Waters and Communities Office (LAWCO) jointly led a collaborative regional workshop process to determine where, from a technical and scientific perspective, actions should be prioritised in the second cycle. The prioritisation process was based on the priorities in the draft river basin management plan, the evidence from the characterisation process, and the expertise, data and knowledge of public body staff with responsibilities for water and the different pressure types. The recommended areas for action selected during the workshops were then agreed by the Water and Environmental Regional Committees. The recommended areas for action are an initial list of areas where action will be carried out in the second cycle. All water bodies that are At Risk still however, need to be addressed. The initial list of areas for action is not therefore considered as a closed or finite list; it simply represents the initial areas where work will be carried out during the second WFD planning cycle from 2018 to 2021.

In the Munster Blackwater Catchment, thirteen river water bodies within have been prioritised for action as the water conservation objectives for their species and/or habitats are not being supported by ecological status. This includes seven water bodies with designated Freshwater Pearl Mussel populations and the reasons for selection included failing to meet protected area objectives for Freshwater Pearl Mussel. None of these have relevance to the proposed development being assessed. The Funshion_080 (A tributary

Catchment: Blackwater (Munster) (Code 18) – 2nd Cycle

>4km east of Fermoy) has been identified as At Risk but it is not a High ecological status objective water body.

(A remaining fifty-eight At Risk and Review surface water bodies were not included in the recommended areas for action for the second cycle.

The proposed development site is located within the Blackwater (Munster) SC_110 and SC_120 sub catchments. Within the Blackwater (Munster SC_110) the issues on the main channel range from elevated nutrients due to a combination of point (Section 4 and licenced facility) and urban diffuse sources on Blackwater (Munster)_130 to unknown pressures driving moderate fish status on Blackwater (Munster)_160. On a tributary to the Blackwater, Ross Killavulleen_010, ecological status declined to Moderate and the significant pressures are a combination of hydromorphology, forestry and nutrients from an urban wastewater treatment plant.

In the Blackwater (Munster_SC_120) two out of six river waterbodies within this sub catchment are AT RISK, Funshion_060 and Funshion_080 due to Moderate biological status. Diffuse agriculture on land underlain by karst limestone is the main significant pressure within both water bodies in addition to point sources from piggeries and road activities within Funshion_080.

Relevant sub-basins are listed below. The proposed development site is located in the Blackwater (Munster)_190 sub-basin. The Blackwater (Munster)_200 sub-basin is located approximately 2km downstream.

Blackwater [Munster] – River Waterbodies relevant to the proposed project

Waterbody	Status 2007-09	Status 10-12	Status 10-15	Status 2013-2018	Protected area (SAC)	Significant Pressures identified	WFD Risk (2nd cycle)	WFD Risk (3rd cycle)
Blackwater (Munster)_190	Poor	Good	Good	Good	Within protected area	None	Not at risk	At risk
Blackwater (Munster)_200	Good	Good	Good	Good	Within protected area	None	Not at risk	Not at risk

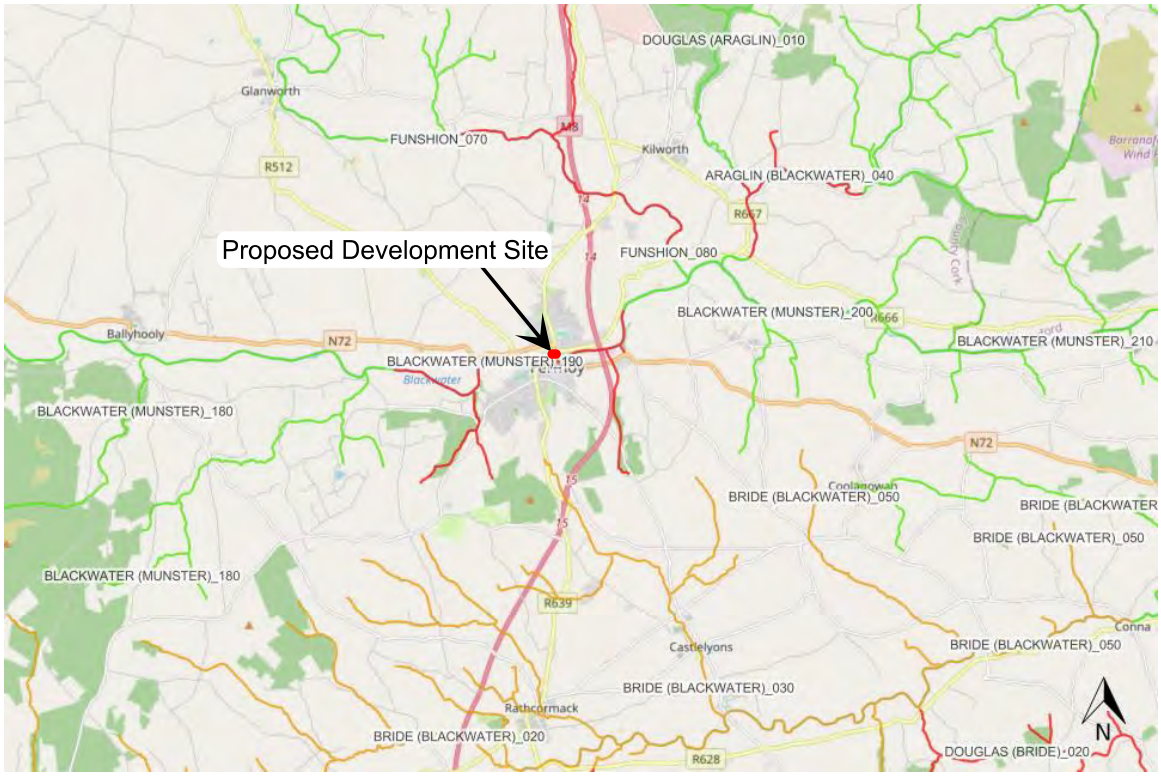

Figure 17. Blackwater [Munster] – River Waterbodies (3rd cycle) relevant to the proposed works (outlined in red) | Source: EPA Envision mapping (https://gis.epa.ie/EPAMaps/) | Not to scale

8.3 Biological Monitoring

To evaluate biological water quality within the survey area, Q-sampling was carried out at n=4 sites in the vicinity of Fermoy Weir (S1-S4; **Figure 9**). Macro-invertebrate samples were converted to Q-ratings as per Toner *et al*. (2005). All samples were taken with a standard kick-sampling hand net (250mm width, 500µm mesh size) from areas of riffle/glide utilising a two-minute sample, as per ISO standards for water quality sampling (ISO 10870:2012). Large cobble was also washed at each site, where present, and samples were elutriated and fixed in 70% ethanol for subsequent laboratory identification. Any rare invertebrate species were identified from the NPWS Red List publications for beetles (Foster *et a*l., 2009), stoneflies (Feeley *et al.,* 2020), mayflies (Kelly-Quinn & Regan, 2012) and other relevant taxa (i.e. Byrne *et al*., 2009; Nelson *et al*., 2011).

A total of n=31 species across n=28 families were recorded in the n=4 Q-samples collected in July 2020. The samples S1 and S2 were collected upstream of the weir and S3 and S4 downstream of the weir. A summary of results is presented in **Table 13** and **Figure 18**.

Following the methodology of Toner *et al.* (2005), the EPA group invertebrates into classes whereby pollution intolerant species are denoted class A, and species with greater pollution tolerance fall into successive classes (B through E, respectively). As such, the presence or absence of these groups and their relative abundance facilitates an assessment of biological river health. Good status (Q4) unpolluted water quality is

achieved according to the EPA if at least one Group A taxon is present in, at least, fair numbers (5-10% total sample composition). Group B taxa may be common or absent and *Baetis rhodani* (large dark olive mayfly) is often dominant. Other Group C taxa are never excessive and group D / E taxa are present in small numbers or absent (Toner et. al., 2005). Our results are discussed in this context in order to interpret potential changes in the macroinvertebrate community composition.

The invertebrate samples (S1 & S2) collected upstream of the weir, in addition to S4 downstream, had moderate status (Q3-4) biological water quality. The recorded water quality was assigned due to small numbers of clean water indicator group A, Heptageniidae mayfly species and a dominance of EPA Group B and C invertebrates (moderate water quality indicators). These included the group B mayfly species *Centroptilum luteolum*, and group C mayfly species, *Seratella ignita* and *Caenis rivulorum*.

A single sample (S3) had Q4 (good status), unpolluted water quality. The sample was well represented by EPA group A clean water indicator species with the stonefly species, *Isoperla grammatica* and two mayfly species present from the group (i.e. *Ecdyonurus insignis* and *Ephemera danica*).

No invertebrate species of higher conservation value than 'least concern' were recorded in the invertebrate assemblage when compared to national red lists (Feely *et al.* 2020; Kelly-Quinn & Regan, 2012; Byrne *et al*. 2009; Foster *et al*. 2009).

Table 13. Macro-invertebrate species composition and Q-ratings recorded on the River Blackwater in the vicinity of Fermoy Weir, July 2020

Family	Species	S1	S2	S3	S4	EPA group
Perlodidae	*Isoperla grammatica*			1		**A**
Heptageniidae	*Heptagenia sulphurea*	1				**A**
Heptageniidae	*Ecdyonurus insignis*		2	2		**A**
Ephemeridae	*Ephemera danica*			3	2	**A**
Baetidae	*Centroptilum luteolum*	5	6		3	**B**
Baetidae	*Baetis rhodani*			1		**C**
Ephemerellidae	*Serratella ignita*	9	8	10	2	**C**
Caenidae	*Caenis rivulorum*	14	4	16	3	**C**
Leptoceridae	*Athripsodes cinereus*	2		2	5	**B**
Limnephilidae	Not speciated - early instar	1				**B**
Hydropsychidae	*Hydropsyche siltalai*	4		2	14	**C**
Hydropsychidae	*Cheumatopsyche lepida*				4	**C**
Polycentropodidae	*Polycentropus flavomaculatus*	2	1	2		**C**
Dytiscidae	*Nebrioporus depressus*		1			**C**
Elmidae	*Limnius volckmari* larva			2	1	**C**
Elmidae	*Elmis aenea* larva	2				**C**
Neritidae	*Theodoxus fluviatilis*	5				**C**
Bithyniidae	*Bithynia tentaculata*	2	7	1		**C**
Planorbidae	*Planorbis planorbis*		2			**C**
Valvatidae	*Valvata piscinalis*	3	3			**C**
Physidae	*Physa fontinalis*		2			**D**
Sphaeriidae	*Pisidium* sp.	1				**D**
Lymnaeidae	*Radix balthica*	6	1	3	1	**D**
Sphaeriidae	*Sphaerium corneum*		2			**D**
Hirudinidae	*Pisciola geometra*			2		**C**
Gammaridae	*Gammarus duebeni*	2	8	4	8	**C**
Assellidae	*Asellus aquaticus*	5	1	4	9	**D**
Simulidae	Not speciated				2	**C**
Chironomidae excl. *Chrionomus* sp.	Not speciated	5	6		6	**C**
Hydrachnidiae	Not speciated	1		1		**C**
Oligochaeta	Not speciated			2	2	**n/a**
Taxon richness		**18**	**15**	**17**	**14**	
Total abundance		**70**	**54**	**58**	**62**	
Q Rating		**Q3-4**	**Q3-4**	**Q4**	**Q3-4**	
WFD Status		**Mod**	**Mod**	**Good**	**Mod**	

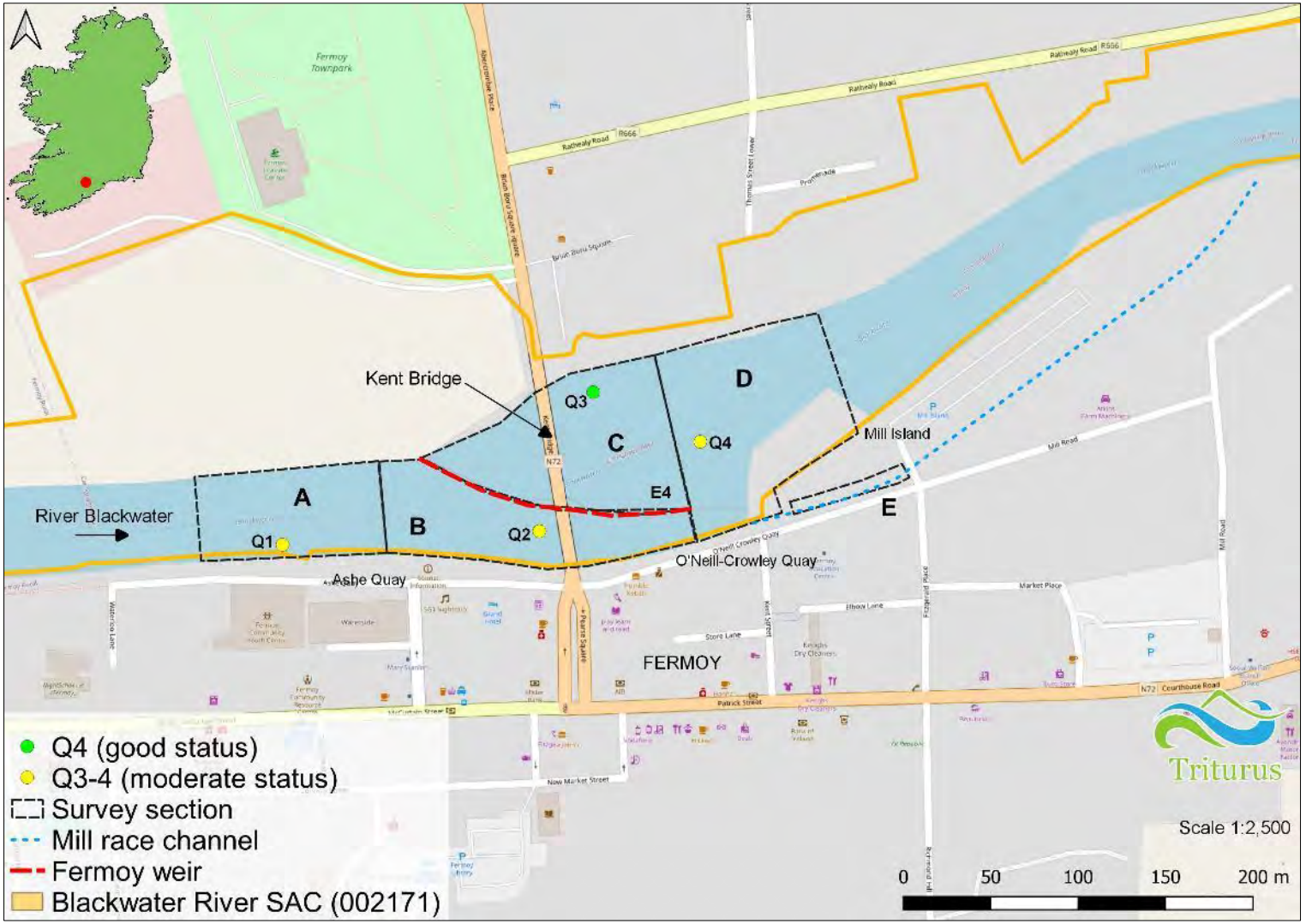

Figure 18. Biological water quality (Q-ratings) recorded within study area July 2020.

9. Evaluation of Potential Impacts

There will be a net loss of terrestrial habitat including trees which may provide refuges for fauna on the northern bank of the River Blackwater. There will be a temporary loss of aquatic habitats during the construction phase.

During construction, potential impacts could arise from increased noise and disturbance which could result in the disturbance/displacement of birds and mammals, including Annex I (EU Birds Directive) species such as Little Egret and Annex II (EU Habitats Directive) species such as Otter. Increased traffic and noise associated with the site works could potentially increase levels of disturbance which could result in the disturbance/displacement of birds and mammals. Increased dust levels during construction could have localised impacts on vegetation and habitats. Lighting during construction may cause disturbance to local fauna.

Works within or in the vicinity of aquatic habitats may cause disturbance to fish and invertebrate species. Discharges of silt, were they to occur through inadequate control of surface water run-off or disturbance of the river bed and riparian zone could impact on fisheries habitat, macroinvertebrate habitat and aquatic ecology in local waterbodies particularly during flood events. Minor spills of hydrocarbons or from the use of cement during construction could impact on groundwater or surface water quality with resultant impacts on aquatic ecology. Works could result in the spread of invasive plant species or crayfish plague.

Potential impacts on designated European sites (SAC/cSAC/SPA) are specifically addressed in an Appropriate Assessment (AA) Screening Report and Natura Impact Statement (NIS) Report which have been submitted as part of this application.

9.1 Do Nothing' Impact

The do-nothing scenario, as the name suggests, involves leaving the weir and existing fish ladder *in situ*, with no further remediation works. The current speed of the waters flowing through the breach in the weir is too fast to facilitate upstream movement of migratory fish and is unable to meet the requirements of IFI in terms of providing fish passage for fish of all species. In the do-nothing scenario, the greater part of the flow range in the river would continue to be funnelled into the Mill Race Channel with resultant high velocities and turbulence acting as a barrier to fish passage.

In the do-nothing scenario, the weir will continue to degrade over time potentially leading to an uncontrolled breach of the weir. In the event of such an uncontrolled breach, the release of silt which has accumulated upstream of the weir could have effects on aquatic species including White Clawed Crayfish, European Eel, Brook Lamprey, Otter (via impacts on prey availability), Freshwater Pearl Mussel and the Annex I habitat floating river vegetation. Freshwater Pearl Mussel are particularly susceptible to increased silt levels. The sudden drop in water levels could also have a detrimental effect on riparian woodland.

Most of the terrestrial habitats to be affected have been significantly modified from their natural state by human activity. Where grassland habitat is left unmanaged a general pattern of succession from grassland to scrub would be expected to occur. If sufficient time elapsed without development, the unused areas of the proposed development area would be expected to develop a covering of woodland with a mix of native and introduced species. Treelines along

the banks of the River Blackwater would continue to provide roosting and nesting habitat for mammals and birds as well as shade and cover for fish species in the do-nothing scenario.

9.2 Impact Appraisal

When describing changes/activities and impacts on ecosystem structure and function, important elements to consider include positive/negative, extent magnitude, duration, frequency and timing, and reversibility (IEEM, 2018).

Section 3.7 of the *Guidelines on the Information to be Contained in Environmental Impact Assessment Reports'*, (EPA 2022) provides standard definitions which have been used to classify the effects in respect of ecology. This classification scheme is outlined below in **Table 14**.

Table 14. EPA Impact Classification

Impact Characteristic	Term	Description
Quality	Positive	A change which improves the quality of the environment.
	Neutral	No effects or effects that are imperceptible, within normal bounds of variation or within the margin of forecasting error.
	Negative	A change which reduces the quality of the environment.
Significance	Imperceptible	An effect capable of measurement but without significant consequences.
	Not Significant	An effect which causes noticeable changes in the character of the environment but without significant consequences.
	Slight	An effect which causes noticeable changes in the character of the environment without affecting its sensitivities.
	Moderate	An effect that alters the character of the environment in a manner consistent with existing and emerging trends.
	Significant	An effect, which by its character, magnitude, duration or intensity alters a sensitive aspect of the environment.
	Very Significant	An effect which, by its character, magnitude, duration or intensity significantly alters most of a sensitive aspect of the environment.
	Profound	An effect which obliterates sensitive characteristics.
Duration and Frequency	Momentary Effects	Effects lasting from seconds to minutes.
	Brief Effects	Effects lasting less than a day.
	Temporary Effects	Effects lasting less than a year.
	Short-term	Effects lasting one to seven years.
	Medium-term	Effects lasting seven to fifteen years.
	Long-term	Effects lasting fifteen to sixty years.
	Permanent	Effects lasting over sixty years.
	Reversible Effects	Effects that can be undone.
	Frequency	Describe how often the effect will occur. (once, rarely, occasionally, frequently, constantly – or hourly, daily, weekly, monthly, annually)
	Irreversible	When the character, distinctiveness, diversity, or reproductive capacity of an environment is permanently lost.
	Residual	Degree of environmental change that will occur after the proposed mitigation measures have taken effect.
	Synergistic	Where the resultant effect is of greater significance than the sum of its constituents.

Impact Characteristic	Term	Description
	'Worst Case'	The effects arising from a development in the case where mitigation measures substantially fail.

10. Potential Impacts on Habitats

10.1 Direct Impacts on Habitats

Direct impacts on terrestrial habitats are generally restricted to removal of habitats. Indirect impacts may occur via damage and disturbance arising from vehicular activities and storage of overburden and materials. Potential impacts on aquatic habitats include physical alteration to the riverbed habitat/morphology, loss of refuges and smothering of habitats due to resuspension of sediments. Levels of dust during construction are predicted to be low and effectively managed by mitigation. The impact on vegetation in adjoining habitats from wind-blown dust is predicted to be imperceptible. No rare floral species were recorded within the study area. Based on the criteria outlined by EPA, 2017, as described above, the predicted impacts are detailed in **Table 15.**

Table 15. Ecological value of habitats recorded within proposed development site and potential impacts of proposed development

Habitat	Ecological value (NRA guidelines)	Potential impacts
Buildings and artificial surfaces BL3	This habitat is located within the Blackwater River (Cork/Waterford) and is therefore classified as Internationally important However, it is considered of Local importance (higher value)	Sections of the weir will be reinstated as detailed in section 3.2.2 and 3.2.3. Negative, not significant, long-term.
Treelines WL2	Local Importance (higher value)	A number of trees within the treelines on the northern banks of the river (upstream of Fermoy Bridge) will be removed to facilitate the installation of the fish bypass channel (approximately 30 trees). Negative, moderate, long-term
Amenity grassland GA2/Dry meadows & grassy verges GS2	Local importance (lower value)	An area of grassland within the proposed development site will be removed to facilitate the installation of the fish bypass channel. Negative, slight, long-term
Depositing/Lowland rivers FW2	International Importance	Temporary damming of the river and weir reinstatement works will lead to temporary impacts on river habitat.

Habitat	Ecological value (NRA guidelines)	Potential impacts
		It is noted that the fish bypass channel will constructed offline on terrestrial habitat. There will be no significant permanent habitat loss of the river habitat. Negative, moderate, short-term
Canal FW3	Local importance (higher value)	The remediation of the Mill Race section of the weir, east of the Bridge, will involve reconstructing the breached sections with existing or new stonework There may be some loss of habitat to this area during construction works. Negative, not significant, long-term
Tall herb swamp FS2/Scrub WS1	International Importance	There will be no direct impact on this habitat.
Scrub WS1	Local importance (Lower value)	A small area of scrub within the proposed development site will be removed Negative, slight, long-term

10.2 Indirect Impacts on Habitats

Significant changes in flow patterns could impact on the distribution of *Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae)*. Investigation of the treelines and woodland habitat within the proposed development site indicate that the trees earmarked for removal do not correspond to a qualifying habitat for Blackwater River (Cork/Waterford) SAC. A small area of woodland habitat approximately 700m upstream of Fermoy Bridge was surveyed and has some characteristics of Alluvial woodland. Notwithstanding that ground flora is typical of riparian woodland, this is not a significant example of the Annex I habitat Alluvial woodland.

It is noted that the existing breach of the weir is relatively recent and this has altered upstream flow dynamics within the River Blackwater, which may be having adverse effects on the poor quality riparian woodland upstream due to lower water levels. The proposed weir remediation works may result is a slight rise in water levels upstream of the weir. This would allow conditions upstream to revert to the baseline conditions that existed when this riparian woodland was developing. Therefore, the works are likely to have a neutral to slightly positive impact on riparian woodland upstream of the works area, by restoring water levels to the previous baseline. This will facilitate the gradual ongoing transition of this largely artificial woodland to a more natural woodland. Downstream of the works there are no areas of alluvial woodland in proximity to the proposed works and no significant impact on water levels or flow

patterns is predicted to occur. Therefore, no effect on Alluvial woodland habitat downstream of the works area will occur.

Temporary damming of the river for weir reinstatement works will lead to temporary impacts on river habitat, including small areas of the Annex I habitat *Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion* vegetation. The current hydrological regime downstream of the site is unstable due to the ongoing erosion of the weir. The reinstatement works will stabilise the hydrological conditions immediately downstream of the weir. While vegetation is likely to recolonize this area following the weir restoration works, weirs can modify flow in complex ways, and this may lead to the loss of species which are sensitive to ponding or slow flows (e.g. *Ranunculus fluitans*). Predicting the changes in habitat distribution due to changes in flow downstream and upstream of the of the weir is difficult. However, it is noted that the macrophytes recorded within the proposed development site and/or survey area represent a common sub-type of this Annex I habitat and no rare subtypes were recorded during site surveys. This habitat can occur over a wide range of physical conditions, from acid, oligotrophic, flashy upland streams dominated by bryophytes to more eutrophic, slow flowing streams dominated by Ranunculus and Callitriche species.

Changes in hydrological regimes could impact on *Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation [3260]* habitat downstream and upstream of the proposed works area. However, it is noted that rivers are dynamic systems which are not necessarily stable overtime and in this instance the breach of the weir has significantly altered flow patterns within the river. The provision of a fish pass will also alter flow dynamics within the river, which may result in changes in distribution pattern for this habitat. However, these changes will not necessarily be either negative or positive. The new flow pattern will be relatively stable overtime once the weir remediation works are complete and will favour the development of this habitat in certain areas and may have a slight detrimental impact in others. It is noted that velocities downstream of the fish bypass channel will be lower than the velocities currently generated through the weir breach and this may encourage colonization by Ranunculus and Callitriche species. Overall, however, there is not likely to be any significant changes in the amount of this habitat and more controlled flow conditions will lead to a more stable hydrological regime which makes it less likely that this habitat will be negatively affected by extreme fluctuations in flow pattern in the future due to the continued deterioration of the weir.

It is also noted this habitat type is commonly distributed along the main Blackwater channel and within tributaries and no rare subtypes were recorded and therefore the proposed development will not significantly impact on the conservation objectives for the Blackwater River (Cork/Waterford) SAC. Impacts on qualifying habitats for the Blackwater River (Cork/Waterford) SAC are specifically addressed by the Natura Impact Statement (NIS) for this development.

10.1 Terrestrial Invasive Species

The third schedule invasive species Japanese Knotweed and Himalayan Balsam were recorded within the proposed development area. There is potential during the construction phase for invasive species to be spread within the proposed development site boundary, thus impacting negatively on adjoining habitats.

Japanese Knotweed and Himalayan Balsam are spread by plant and rhizome fragments of plants or in contaminated soil. Mitigation measures during construction will ensure that no movement of soil or plant material potentially containing fragments of these species outside of the currently contaminated area will take place. An Invasive Species Management Plan (ISMP) has been prepared for the project and is attached as **Appendix 5**.

11. Potential Impacts on Fauna

11.1 Mammals

11.1.1 Otter

The proposed development site is located within the Blackwater River (Cork/Waterford) SAC for which Otter is listed as a qualifying interest. Aquatic/riparian habitats within the study area provide valuable habitat for Otter. The existing weir face is regularly used feeding and resting area. An Otter holt was recorded approximately 300m east of the proposed development site boundary.

There will be a long-term net loss of common habitat types i.e. amenity grassland and treelines, located within the development site. There will also be a temporary loss of river habitat and the resting/feeding areas along the weir structure during construction works. Increased noise and disturbance is predicted to occur during construction, including significant noise from sheet piling for the weir and fish bypass channel works. This is likely to result in short term disturbance or displacement of Otter during the construction phase.

Construction works will take place during normal working hours which will avoid the largely nocturnal foraging period of Otter. A buffer zone of 150m will be maintained between the Otter holt and construction works. It is noted that no piling works are proposed downstream of the bridge, in the vicinity of the Otter holt and no vibration impacts are predicted to occur at the Otter holt.

A range of standard mitigation procedures will be employed during construction to minimise impacts on water quality which could impact on prey availability for Otter. Specific non-standard measures have also been specified for weir reinstatement works. These mitigation methods will effectively prevent impacts from silt and hydrocarbons. In particular, the use of temporary dams will allow works to be carried out in the dry which minimises the risk of potential impacts. Following the implementation of mitigation measures, no impact on water quality and thus no significant impacts on Otter are predicted to occur during construction.

Noise and disturbance will return to baseline levels following construction and no operational noise impacts will occur. No lighting is proposed within the fish bypass channel or weir structure. Otter are likely to return to use the weir following completion of site works. Therefore no significant impacts are predicted to occur during the operational phase due to noise and disturbance.

Whilst works could potentially disrupt feeding patterns, given the short-term nature of the disturbance, the often-nocturnal habits of Otter and the ability of Otter to move away from disturbance, no significant impact on the feeding behaviour of this species is predicted to occur. In the absence of significant impacts on water quality, no significant impact on prey availability will occur and the loss of terrestrial habitat will not have a significant impact on this

species in the context of the extent of similar habitat available to this species within the Blackwater catchment. No barriers to connectivity have been identified. During construction the proposed development will have a negative, moderate and short-term impact on Otter. During operation there will be no significant impact on Otter.

11.1.2 Bats

The treelines on the northern banks of the river and river channel provide habitat for foraging bats. A bat survey carried out along the River Blackwater found small numbers of bats foraging along the river channel and the treeline areas. The species recorded were Common Pipistrelle, Daubenton's, Leisler's, Brown Long-Eared and Soprano Pipistrelle bats.

Bats rest, give birth, raise young and hibernate in tree holes, crevices and beneath loose bark. Species of trees utilised by bats include oak, ash, beech and Scots pine. Trees, especially native ones also play host to numerous insect species which are prey items for bat species. Approximately 30 trees will be removed during the construction of the fish bypass channel. A number of mature non-native trees will be removed, including six mature Lime trees, dating from the 1800's and two mature Black Poplar. These provide moderate roost potential for bats. It is noted that mature native Alder and one over mature tree will be retained as part of the landscape plan. No bats were recorded emerging from these trees in the footprint of the fish bypass channel and they are unlikely to support large roosts.

Lighting deters some bat species from foraging. Studies have shown that illumination levels as low as 0.06 lux can have an effect on the behaviour of bats. Even a full moon night (0.02 lux) can reduce bat activity to more sheltered, darker wildlife corridors and foraging areas (e.g. woodlands). The slower flying broad-winged species (Natterer's bats, Daubenton's bats, Whiskered Bats, Brandt's Bats, Lesser Horseshoe Bats and Brown Long-eared bats) have been shown to avoid streetlights. In a study of a roost in Suffolk, UK, the numbers of Natterer's bats, Whiskered bats, Daubenton's Bats and Brown Long-eared Bats fell after the installation of streetlights adjacent to the roost being monitored.

Lighting for the proposed development will be largely confined to the construction phase. No operational lighting will be required. The landscape plan includes planting along the northern and southern boundary of the fish pass and this will prevent light spillage from existing public lighting during operation. During construction mitigation measures will ensure that where lighting is required it will be directed away from the treelines and the areas of the River Blackwater outside the immediate working area. This will ensure that there is no light spillage and/or lighting disturbance for bats within this area.

Overall, there will be a net loss of foraging and the loss of some low to moderate value potential roosting habitat for bats. Bat boxes will be installed to mitigate against the loss of potential roosting habitat. Trees also provide shelter for swarming insects which bats will avail of and provide important commuting routes for bats. A gap in a hedge/treeline of greater than 10m may force some species of bats seek an alternative commuting route. The landscape plan includes native tree planting, a riparian enhancement area as well as a Willow treeline along the northern and southern boundary of the fish bypass channel. The use of native trees is considered very important in increasing the ecological value of a given site. For example, native Willow can support over 200 species of insect, a non-native conifer such as Leyland Cypress will support very few. Essentially the tree planting will provide a high quality,

alternative treeline connecting to treelines to the east and west of the proposed development site. In the medium to long-term this will provide a foraging/commuting route for bats and prevent the loss of connectivity with other foraging areas along this area of the River Blackwater. In the long-term these trees are likely to provide roosting sites for local bat populations. During construction the proposed development will have a negative, moderate and short-term impact on a local bat populations. During operation the impact on local bat populations will not be significant.

11.1.3 Other Mammals

There will be a net loss of amenity grassland and treeline habitat which may support relatively common mammal species. Increased noise and disturbance is predicted to occur during construction phase. This is predicted to be a short term, negative impact.

Following construction, noise and disturbance is likely to return to pre-construction levels. It is noted that wildlife that utilise the area, i.e. within a busy urban setting, are likely to be habituated to relatively high levels of disturbance. The landscape plan includes native tree planting, a riparian enhancement area as well as a Willow treeline. The use of native trees is considered very important in increasing the ecological value of a given site. For example, native willow can support over 200 species of insect. The incorporation of a range of native species which flower and fruit at different times can help to support invertebrate species at different stages of their lifecycle and will also help to create a natural woodland structure. This will provide alternative refuges and foraging habitat for mammal species.

During construction the proposed development will have a negative, slight and short-term impact at a local level. During operation the impact on other mammal species will not be significant.

11.2 Birds

The terrestrial bird species recorded during bird surveys are typical of the types of habitat recorded on site and are generally common. One Annex I species i.e. Little Egret and one Red List species, i.e. Grey Wagtail, were recorded during site surveys. However, it is noted that although Little Egret is an Annex I species, in Ireland this is a Green List species and not a species of conservation concern. The removal of 30 trees on the northern banks of the River Blackwater will result in the loss of potential nesting and roosting habitat for birds.

The Red List species Grey Wagtail and a number of Amber List species i.e. Mute Swan, Black-Headed Gull and Mallard, use the River Blackwater for foraging. Some displacement of feeding birds is predicted to occur during construction due to increased noise and disturbance. Marginal vegetation, particularly on the northern banks downstream of Fermoy Bridge is likely to provide breeding habitat for waterbirds such as Moorhen, Mute Swan and Mallard. Although these habitats are outside the works area and will be not be directly impacted, there may be short-term disturbance to breeding birds which use these habitats during the construction phase. Disturbance can cause sensitive species to deviate from their normal, preferred behaviour, resulting in stress, increased energy expenditure and, in some cases, species mortality. However, construction works will be short-term in duration.

No Kingfisher breeding sites were recorded during site surveys and no potential breeding habitat will be directly affected. However, some impacts on feeding behaviour could result

from increased noise and disturbance during construction works, resulting in a short term, minor impact. Mitigation measures will ensure light and noise levels during construction will be kept to a minimum. Any disruption of Kingfisher and other birds foraging along the River Blackwater will be short-term and slight. Noise and disturbance will return to previous levels following construction and given there will be no long-term habitat loss, Kingfisher are expected to continue to use habitats within the proposed development site following construction.

During the operational phase, the levels of activity will stabilise and birds in the surrounding landscape will be expected to habituate to any noise and disturbance. The landscape plan includes native tree planting, a riparian enhancement area as well as a Willow treeline along the northern and southern boundary of the fish bypass channel. Therefore, in the medium to long-term, the landscape plan will provide foraging and nesting resources for local bird species.

During construction, the proposed development will have a negative, slight and short-term impact at a local level. During operation the impact on local birds will not be significant.

11.3 Impact on aquatic species

11.3.1 Impact on fish during construction

A number of fish species and aquatic invertebrate species use the freshwater habitats within the proposed development site i.e., Brown Trout, Atlantic Salmon, Minnow, Roach, European Eel, Three-spined Stickleback, Gudgeon, Stone Loach, Lamprey species and White-clawed Crayfish. It is also noted that the invasive species, Dace was recorded during electrofishing surveys. The survey also concluded that excellent spawning habitat for salmonids, as well as good spawning habitat for lamprey species and European Eel, was present within the proposed development site.

Direct impacts during construction works will be prevented by removing fish including juvenile lamprey in sediments from the area of river within barriers and dams.

As the weir reinstatement works within the River Blackwater will be carried out in two stages, there will no significant impedance of fish movement. In addition, construction activities will be undertaken during daylight hours only and will ensure that there is potential for undisturbed passage at night, when main surges of migratory fish are more likely to occur. The works will not create any new barriers to migrations. It is noted that the current breach in the weir (and weir breach) create a barrier to migration (AMBER barrier database). Thus, no direct impact on fish species is predicted to occur during construction works.

Bed Load (coarse material transported along the bottom of the stream) and settled sediments can infill pools and riffles, reducing the availability and quality of habitat for fish. This has been minimised though the proposed mitigation measures and the scheme design, which will reduce habitat loss within the river channel, including potential spawning habitat.

Following completion of works the riverbed habitat will be reinstated. It is noted that some mobilisation of silt will occur. However, based on the short-term nature of the works, which will be carried out in the dry, the seasonal restrictions pertaining to the project, the implementation of detailed and site-specific mitigation measures and the recreation of instream habitat post-

construction where required, there will be no significant decline in the extent and distribution of spawning beds and the long-term impact on spawning habitat is not predicted to be significant. Thus the impact on fish and invertebrate habitat is predicted to slight, negative and short term.

Riparian treeline habitats with overhanging vegetation are important for migration as they provide areas of cover in which fish rest and stabilise river banks. These marginal areas also provide protection from predators and direct sunlight and consequently fish may remain in these areas for extensive periods of time. The construction plans for the development involves limiting the removal of significant riparian vegetation which will regrow and/or be replanted. The landscape plan for the proposed development includes native tree planting, a riparian enhancement area as well as a Willow treeline along the northern and southern boundary of the fish bypass channel. These measures will create alternative refuges and the use of native species will increase invertebrate prey for fish species along the river margins.

Based on the short-term nature of the works which will be carried out in the dry, the seasonal restrictions pertaining to the project, the implementation of detailed and site-specific mitigation measures, the incorporation of native species into the landscape plan and the reinstatement of instream habitat post-construction there will be no significant impacts in respect of distribution, population structure of or breeding success of fish species in the medium to long term. No significant negative impact on water quality during construction or operation is predicted to occur. The impact of the proposed development on fish species during construction is predicted to be negative, not significant and short term.

11.3.2 Impacts on Fish Passage During Operation

The proposed fish bypass channel has been designed to provide passage for all fish species including Atlantic Salmon, lamprey species, Twaite Shad and crayfish. An independent review of the operational design of the fish bypass channel was carried out by Royal Haskoning DHV (RHDHV). The aim of this review was to assist in confirmation of the proposed hydraulic design of a fish bypass channel around the weir. The scope of this assessment comprised a hydraulic design review of the bypass channel and remediated existing weir at Fermoy. To inform the hydraulic design review, a Computational Fluid Dynamics (CFD) model was required to determine if velocities within the fish bypass channel comply with the maximum speed requirements for a variety of fish species. Further details on the CFD modelling exercise and fish bypass channel assessment are included in the planning application (See Engineering Technical Report 19011-TJOC-PL-XX-PD-C-3709 Appendix D).

Table 16 **and Table 17** provide approximate values of swim speeds and minimum depths for key fish species which the fish bypass channel should accommodate for a range of flows. It should be noted, if information on fish migration and flow is not available for the site, then it is suggested that the facility for upstream migration should be designed to operate across a flow range from Q90 to Q10 for Salmon; Q95 to Q10 for Sea Trout and Brown Trout; Q50 to Q20 for coarse fish and shad; and Q99 to Q70 for European Eel. It should be noted, on the condition that the flow velocity remains significantly less than the maximum speed, fish can swim more or less at their cruising speed through a fish bypass channel.

Table 16. Generic Swim Speeds of Key Fish Species and Migration Windows

Species	Mean Burst (Swim) Speed	Median Sustained Swim Speed	Maximum Swim Speed	Upstream Migration Window
Salmon	> 1.2 m/s	-	4.5 - 6.5 m/s	October to May (Key Spawning Season, although peak months are October to November for Salmonids)
Sea / Brown Trout	1 35 m/s	1.17 m/s	1.8 - 5 m/s	
European Eel	1.14 m/s	0.25 m/s	Young eel < 0.5 m/s Adult eel <1.5 m/s	
Coarse Fish (based on Chub)	1.3 m/s	0.93 m/s	4 m/s	April – July
Sea Lamprey	-	-	5 m/s	
River Lamprey	-	-	3.5 m/s	
Allis shad	-	-	4.1 - 6.1 m/s	
Twaite Shad	1.52 - 2.06 m/s	0.44 – 0.59 m/s	2.7 - 5.4 m/s	

Source: IFM/Environment Agency Fish Pass Manual (2015); The ICE Protocol for Ecological Continuity-Assessing the Passage of Concepts, Design and Application (2014); CSAS Fish Swimming Performance Database and Analyses (2016)

Table 17. Generic Swim Depths of Key Fish Species

Species	Minimum Depths (m)
Salmon	0.2 m
Sea / Brown Trout	0.05 m – 0.1 m
European Eel	0.2 m
Coarse Fish (based on Chub)	0.05 m – 0.1 m
Sea Lamprey	0.15 m
River Lamprey	
Allis shad	0.2 m – 0.3 m
Twaite Shad	

Source: The ICE Protocol for Ecological Continuity-Assessing the Passage of Concepts, Design and Application (2014)

To inform the hydraulic design review, a CFD model was used to determine if flow conditions within the fish bypass channel complied with the requirements for a variety of fish species.

An initial design option was tested in the CFD model, however results showed that the required velocity threshold was exceeded within most of the gaps/slots in the first (most upstream) fish bypass channel. To reduce velocities, a revised option was modelled which incorporated increasing the width of three of the gaps/slots and incorporating a flat “sill” in the bed immediately upstream of the first weir.

The revised option of the design was tested for the three flow conditions (Q95, 0.7AADF and 1.0AADF). Results showed that the velocities remain relatively high i.e. above the 2ms-1

threshold stated in DVWK guidance within two of the five gaps at the first fish bypass channel, however velocities in the other three gaps were tolerable for different fish species. The higher velocities in the two gaps can be reduced by introducing perturbation boulders upstream of the inlets of these gaps. The exact configuration and orientation of the boulders is best established in-situ when the channel has been constructed.

The design review completed by RHDHV includes the following comment in respect of energy dissipation.

Volumetric power dissipations calculated for the 12 pools within the fish bypass channel are comfortably within the limits for all modelled flows. The IFM Fish Pass Manual recommends that as the number of pools increases, maximum values should be at the lower end of the acceptable range. Larinier (2002) notes that 200 W/m^3 is generally taken as the upper limit for volumetric dissipated power in salmon and Sea Trout fish passes. Higher Pv figures may be accepted if the fishway consists of a few pools only, or for very large fish facilities with discharge flows of more than several m^3/s. This publication also noted that lower levels are advisable (less than 150 W/m^3) for small fishways, and for fishways designed for shad and riverine species. The levels predicted at the proposed fish bypass channel in ***Table 18*** *are below the 150 W/m^3 which are advisable for even the slowest fish species i.e. Twaite Shad (Larinier 2002).*

Table 18. Volumetric power dissipation calculations

Event	Max power dissipation W/m3	Min power dissipation W/m3
Q95	80	30
0.7AADF	120	50
1.0AADF	130	60

The CFD model results also show that there is no issue with exceeding the flow velocities threshold throughout the rest of the fish bypass channel, where velocities are well below 1ms-1 and therefore compliant with the fish swim speeds (**Table** 16) and volumetric dissipated power (**Table 18**).

As noted above the design of the fish bypass channel ensures that flow velocities and turbulence round the weir are in compliance with all relevant guidelines. The design of the fish bypass channel mirrors natural river flow patterns and velocities and there are no areas in which fish may be slowed or trapped within the channel or at the entrance or exit. There will be no lighting of the fish bypass channel during operation. While some predation is likely to occur within the fish bypass channel, this will not be significantly higher than other sections of the main river channel. No impact from increased predation within or around the fish bypass channel is predicted to occur.

Based on the results of the CFD model, it is concluded that the proposed design does perform hydraulicly as intended, although compliance with fish regulations needs to be considered in greater detail to address the velocities within some sections of the bypass channel exceeding threshold set by the DVWK guidance. Some additional measure could be implemented to improve the design, e.g. perturbance boulders could be added to disrupt the flow and slow

velocities in the upper pools in front of gaps at the fish pass weir where the velocities are the highest. Further comments on the design review and recommendations are discussed in the main Fermoy Fish Pass – Hydraulic Design Review Technical Note (NIS Appendix 6). It is noted monitoring of the efficiency of the fish bypass channel will be carried out during operation, through flow monitoring and operational monitoring of fish passage ((**Section 14.19**).

Therefore the impact on fish passage on all fish species during the operational stage will be positive, significant and long-term.

11.3.3 Operational Monitoring of Fish Passage

The *Fermoy Fish Pass Hydraulic Design Revie*w (RHDHV 2021) noted the following:

It should be noted that the DVWK guidance suggests that the characteristics of irregular rough-channel pool passes cannot be calculated accurately and that a degree of testing and modification should be allowed for during the construction phase. Post construction monitoring of the efficacy of the fish pass for the various target species is also recommended, particularly for shad.

Following these recommendations Trex Ecology were commissioned to carry out the following:

1. A high-level review of the provided documentation describing passage conditions for all relevant receptors within the Blackwater River (Cork/Waterford) SAC site designation.

2. Identification of suitable post operational monitoring approaches to determine the efficacy of the bypass channel for fish migration, focused on the relevant receptors from the Blackwater River (Cork/Waterford) SAC.

3. A technical note detailing the findings and conclusions from the above tasks.

Full details of this report have been included with the planning application (See Engineering Technical Report 19011-TJOC-PL-XX-PD-C-3709 Appendix C). The conclusions of the Trex report are outlined below and the report is attached as (See DixonBrosnan 2022 Natura Impact Statement (NIS) for Fermoy Weir Remediation and Fish Bypass Channel, Fermoy, Co, Cork **NIS Appendix 7**).

Overall

- Due to factors such as river size, range of target species, cost and effectiveness, no monitoring approach can be proposed to fully quantify fish passage.

- Monitoring approaches are proposed therefore to verify hydraulic performance of the pass, and to monitor the relative abundance and distribution of fish communities within the River Blackwater following fish pass construction.

Fish pass design

- The fish pass is a large structure with an associated high volume of total flow; however, it does not meet the 50% requirement proposed by IFI at 1 AADF. Nonetheless

concentration of 43% of flow (at that flow level) within a much smaller relative area is likely to allow fish to easily find the entrance.

- Flow velocity at the exit breaches the 2m/s velocity at certain points, although does not seem to breach the burst swimming capabilities of many fish. These points should be monitored post construction at safe flows.

- Some post construction adjustment may be necessary.

Monitoring

- On the grounds of cost and effectiveness direct monitoring (i.e., electrofishing surveys) and counters have been ruled out.

- eDNA methods have been proposed as the most effective solution give catchment location of the fish pass, the range of target fish with distinct life history traits and behaviours, and catchment size.

- A metabarcode all-species approach is proposed, although at a minimum shad and lamprey spp. should be included.

- A baseline should be established, with post operational monitoring to extend to ten years.

- An opportunity to include Freshwater Pearl Mussel (FPM) within the eDNA monitoring programme exists.

11.3.4 Impacts from spread of invasive species

There is potential during the construction phase of the proposed works for invasive species to be spread within the River Blackwater thus impacting negatively on aquatic species. It is noted that biosecurity best practice was observed during all survey work within the River Blackwater channel.

Crayfish plague is listed as one of Ireland's most invasive species by Invasive Species Ireland. This species is listed by DAISIE as among 100 of the worst invasive species in Europe. All non-native crayfish, which may be carriers of the crayfish plague, are listed on the Third Schedule Part 2 of the European Communities (Birds and Natural Habitats) Regulations 2011 in Ireland. Crayfish occur within the Blackwater system and establishment of the disease crayfish plague can have highly detrimental impacts on this species. Throughout its European range, this species has been decimated by the impact of Crayfish plague disease which spread to Europe with the introduction of the plague carrier North American species of crayfish. Biosecurity protocols will be strictly enforced. Construction plant used for instream works could potentially spread Crayfish Plague within the River Blackwater. A Biosecurity Management Plan which will be prepared by the contractor and approved by the supervising ecologist prior to the commencement of site works. The Biosecurity Management Plan will take into account up do date information with respect to biosecurity risks. Biosecurity protocols will be strictly enforced as the risks associated with non-compliance are high. Protocols will follow Irish Waters Standard Operation Procedures and guidance. These measures will ensure that construction works do not spread Crayfish plague within the River Blackwater.

As noted in **Section 7.6**, the non-native fish species Dace was recorded both upstream and downstream of the proposed development site. The results of the site surveys indicated that Dace are currently able to pass freely through the existing Fermoy weir. The proposed fish bypass channel will allow all fish species to travel through this section of the River Blackwater. Given that the existing situation does not provide an impediment to Dace, any change in passage of this species will have a neutral impact on the numbers of Dace both upstream and downstream of Fermoy Weir. Therefore the proposed development will have a neutral impact on the spread of Dace within the River Blackwater.

Overall, the implementation of standard mitigation measures will ensure there is no significant ecological effect from biosecurity or the spread of invasive species.

11.4 Impacts on other fauna

The works will impact on the existing river substrate of mixed stone and gravel and will result in the removal of crevices within the weir which may provide suitable refuges for White-clawed Crayfish. The use of geotextile and rock amour will alter the habitat within the works area and may result in the loss of refuges for White-clawed Crayfish. It is noted that White-clawed Crayfish are gradually colonising the River Blackwater and there is likely to be large areas of habitat which is available to this species. A trapping programme will be implemented to ensure that any Crayfish within this area are removed prior to the commencement of works. Overall, the impact on White-clawed Crayfish is predicted to be negative, not significant and long term.

No Freshwater Pearl Mussel were recorded in this area during FPM surveys for the Fermoy Weir Remediation Project in 2020. There are no known areas of active recruitment downstream of the works and mitigation measures outlined in **Section 14.3 and 14.4** will prevent significant deposition of fine material into River Blackwater. The impact on Freshwater Pearl Mussel will be neutral, not significant and long term.

12 Potential impact on water quality

12.1 Impacts on water quality during the construction phase

Site preparation for weir remediation works and surface water emissions associated with the proposed development could impact on aquatic habitats via increased silt levels in surface water run-off and resuspension of riverbed sediments and inadvertent spillages of hydrocarbons from fuel and hydraulic fluid and contamination by cement.

Inadvertent spillages of hydrocarbon and/or other chemical substances during construction could introduce toxic chemicals into the aquatic environment via direct means, surface water run-off or groundwater contamination. Some hydrocarbons exhibit an affinity for sediments and thus become entrapped in deposits from which they are only released by vigorous erosion or turbulence. Oil products may contain various highly toxic substances, such as benzene, toluene, naphthenic acids and xylene which are to some extent soluble in water; these penetrate into the fish and can have a direct toxic effect. The lighter oil fractions (including kerosene, petrol, benzene, toluene and xylene) are much more toxic to fish than the heavy fractions (heavy paraffins and tars). In the case of turbulent waters, the oil becomes dispersed as droplets into the water. In such cases, the gills of fish can become mechanically contaminated and their respiratory capacity reduced. However, any such spills, in the unlikely event of their occurrence, would be minor in the context of the available dilution in the River Blackwater.

Hydrocarbon contamination, if severe, could potentially impact on water quality and thus could impact on aquatic species including Brown Trout, European Eel, Sea Lamprey, Brook lamprey, White Clawed Crayfish, River Lamprey and Atlantic Salmon. Significant impacts on fish stocks could impact on Otter due to a reduction in prey availability

A range of mitigation measures have been specified to minimise the risk of such spills occurring and measures have been specified to effectively deal with such spills were they to occur. It is also noted that any spills would be minor in the context of the dilution provided within the River Blackwater. No significant impact on water quality from hydrocarbons or other chemical spills during construction and thus on fish and aquatic invertebrates is predicted to occur.

High levels of silt can impact on fish species, in particular spawning salmonids. If of sufficient severity, adult fish could be affected by increased silt levels as gills may become damaged by exposure to elevated suspended solids levels. If of sufficient severity, aquatic invertebrates may be smothered by excessive deposits of silt from suspended solids. In areas of stony substrate, silt deposits may result in a change in the macro-invertebrate species composition, favouring less diverse assemblages and impacting on sensitive species. Cement can also affect fish, plant life and macroinvertebrates by altering pH levels of the water. Silt can have a particularly detrimental impact on spawning habitat for salmon and lamprey species.

Aquatic plant communities may also be affected by increased siltation. Submerged plants may be stunted and photosynthesis may be reduced. Qualifying habitats which are estuarine or terrestrial in nature are very unlikely to be affected; however, there could be an impact on the river habitat water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation within and downstream of the proposed development site.

Increased silt levels, if severe, could potentially impact on water quality and thus could impact on aquatic species within the River Blackwater Brown Trout, European Eel, Sea Lamprey, Brook lamprey, White Clawed Crayfish, River Lamprey, Freshwater Pearl Mussel and Atlantic Salmon. Significant impacts on fish stocks could impact on Otter due to a reduction in prey availability.

Due to the location and nature of the development, there is the potential for silt in surface water run-off and silt from instream works to impact the River Blackwater. A range of standard mitigation procedures will be employed during construction to minimise the potential for impacts on water quality. Specific non-standard measures have also been specified in relation to weir reinstatement works. Where possible the use of natural cement (prompt) in place of traditional cement will further reduce potential impacts. These mitigation methods and design measures will effectively prevent significant impacts from silt, hydrocarbons and cement. In particular the use of a temporary dam will allow works to be carried out in the dry which minimises the risk of potential impacts. Following the implementation of mitigation measures, no significant impact on water quality and thus on aquatic ecology during construction is predicted to occur. The overall impact is predicted to be negative, moderate and short term at a local level.

12.2 Impacts on water quality during the operation phase

The CFD model also shows that velocities around the Fermoy Bridge piers are well below 0.5m/s with small sections with velocities up to 0.9m/s. However, such velocities are not caused by the flow through the fish pass but rather over the Fermoy weir. Velocities within the fish pass at the downstream end are relatively low. The presence of the weir does not show any adverse effect on scour around the bridge piers and therefore the re-constructed structure would also not impact the safety of the bridge or to impact significantly on aquatic or riparian habitats due to scour or bank collapse. The results of the flood risk assessment have concluded that there will be no increase in flood risk or increase in water levels alongside the flood defences (See 19011-TJOC-PL-XX-PD-C-3708_Flood_Risk_Assessment).

It is noted that rivers are dynamic systems which are not necessarily stable overtime and in this instance the breach of the weir has significantly altered flow patterns within the river. The provision of a fish pass will also alter flow dynamics within the river. However, these changes will not necessarily be either negative or positive. The new flow pattern will be relatively stable overtime once the weir remediation works are complete. It is noted that velocities downstream of the fish bypass channel will be lower than the velocities currently generated through the weir breach.

Based on the results of the CFD model, it is concluded that the proposed design does perform hydraulicly as intended, although compliance with fish regulations needs to be considered in greater detail to address the velocities within some sections of the bypass channel exceeding threshold set by the DVWK guidance. Additional measures will be implemented during operation to improve the design, e.g. perturbance boulders will be added to disrupt the flow and slow velocities in the upper pools in front of the gaps at the fish pass inlet weir where the velocities are the highest. Further comments on the design review and recommendations are discussed in the main *Fermoy Fish Pass – Hydraulic Design Review Technical Note* (See **NIS Appendix 6**).

It is noted monitoring of the efficiency of the fish bypass channel will be carried out during operation, through flow monitoring and operational monitoring of fish passage (See **Section 14.19**).

13. Cumulative Impacts

Cumulative impacts on fauna during construction chiefly relate to increased noise and activity levels and potential impacts on water quality. Cumulative impacts during construction will be short-term and localised. As this proposed development is not predicted to significantly increase long term noise and disturbance levels or impact significantly on water quality, no significant cumulative impacts have been identified.

During operation the proposed development will allow free passage of fish through this area of the River Blackwater. Both Fermoy Weir and Clondulane Weir (located approximately 5km downstream of Fermoy Weir), have been identified as barriers to fish passage along the River Blackwater (AMBER barrier database, accessed 10/04/22). Clondulane Weir is a significant barrier to free movement of fish through the River Blackwater and its removal will improve fish passage. An application for the removal of a 50m section of Clondulane Weir was submitted to Cork County Council (Ref 194958). It is an assumption that this barrier will be removed in the near future and there is currently a High Court removal order on Clondulane Weir.

14. Mitigation Measures

14.1 Design Stage Mitigation Measures

There are a number of measures that have been built into the project at the design stage to ensure that the impacts of the proposed development on internationally, nationally and locally important habitats and wildlife are minimised during construction and operation.

These measures include:

- Fish bypass channel has been designed to allow free passage of all fish species through Fermoy Weir. This design was independently reviewed
- Fish bypass channel has been designed to maintain natural hydrological flows within the main channel of the River Blackwater
- Risk of predation for fish using the channel has been minimised through maintenance of natural hydrological conditions, no lighting during operational phase and tree planting to prevent light spillage (from existing lights)
- Weir remediations works have been designed to avoid direct removal and/or damage to aquatic habitats
- The sequence of construction works has been designed to allow the preservation of stream flows for movement of fish by ensuring a minimum depth of water shall be maintained within the River Blackwater throughout the construction works (See **Section 3.3**). Stage 1 works on the north bank of the river shall proceed as an offline construction. The tie ins from the fish bypass channel to the river shall be completed after the Stage 2 works (remediation the weir upstream of Fermoy Bridge) are

complete. Stage 3 works (remediation of the weir downstream of the bridge) shall not commence prior to the completion of Stage 2 (weir remediation works upstream of the bridge) and the completion of the fish bypass channel tie ins to the River Blackwater. The sequence of works shall be agreed with IFI and in compliance with the CEMP.

- Fish bypass channel location will avoid any direct impacts on terrestrial qualifying habitats for the Blackwater River (Cork/Waterford) SAC
- Planting of native trees has specified used in the landscape plan
- Regrading of soil around the fish bypass channel works areas will blend into existing grass open space.

14.2 Construction phase mitigation measures

The mitigation measures to be implemented are based on proven technology and techniques. Works will be monitored by an Ecological Clerk of Works (ECoW) to ensure they are effectively implemented. The ECoW will have at least 10 years' experience as a senior ecologist and will have expertise in freshwater ecology and Otter ecology.

A detailed Construction Stage Environmental Management Plan (CSEMP) will be developed by the appointed Contractors. A draft outline Construction Management Plan (OCMP) and parent Construction Environmental Management Plan (CEMP) have been prepared which respectively detail the construction sequence and all of the construction mitigation measures, which are set out in this EcIA report. The principal mitigation measures are detailed below and are set out in the CEMP.

Construction best practice measures (of relevance in respect of any potential ecological impacts) will be implemented throughout the project, including the preparation and implementation of detailed method statements. The mitigation measures detailed herein have been devised in line with the following guidelines:

- NRA (2010) *Guidelines for the Management of Noxious Weeds and Non- Native Invasive Plant Species on National Roads. National Roads Authority, Dublin*.
- *IW-AMP-SOP-009 Information and Guidance Document on Japanese knotweed*
- *Asset Strategy and Sustainability and Invasive Species Ireland Best Practice Management Guidelines for Himalayan Balsam*
- IFI (2016) *Guidelines on protection of fisheries during construction Works in and adjacent to waters (IFI, 2016)*
- H. Masters-Williams et al (2001) *Control of water pollution from construction sites. Guidance for consultants and contractors (C532). CIRIA.*
- E. Murnane, A. Heap and A. Swain. (2006) *Control of water pollution from linear construction projects. Technical guidance (C648). CIRIA.*
- E. Murnane et al., (2006) *Control of water pollution from linear construction projects. Site guide (C649). CIRIA.*

All personnel involved with the project will receive an on-site induction relating to operations and the environmentally sensitive nature of the Blackwater River (Cork/Waterford) SAC and to re-emphasise the precautions that are required as well as the precautionary measures to be implemented. Site managers, foremen and workforce, including all subcontractors, will be suitably trained in pollution risks and preventative measures.

All staff and subcontractors have the responsibility to:

- Work to agreed plans, methods and procedures to eliminate and minimise environmental impacts,
- Understand the importance of avoiding pollution on-site, including water pollution, noise and dust, and how to respond in the event of an incident to avoid or limit environmental impact;
- Respond in the event of an incident to avoid or limit environmental impact;
- Report all incidents immediately to their line manager;
- Monitor the work place for potential environmental risks and alert the immediate line manager if any are observed; and
- Co-operate as required, with site inspections.

14.3 Construction Works – Hydrocarbons and Waste Management

- A construction and demolition waste management plan will be developed by the main contractor prior to construction works commencing on site. The Plan will meet the requirements of the DoEHLG *Best Practice Guidelines on the Preparation of Waste Management Plans for Construction & Demolition Projects*.
- Oil, petrol and other fuel containers will be double-skinned and bunded to be able to contain 110% volume to guard against potential accidental spills or leakages entering local watercourses linked to the European sites. Bund specification will conform to the current best practice for oil storage such as Enterprise Irelands Best Practice Guidelines. Construction materials will be stored in a secure compound to prevent the potential for vandalism and theft of material.
- Dedicated fuel storage areas will be introduced on-site which shall be a minimum of 50m from watercourses or drains or, alternatively, fuelling will take place offsite (Drawing 19011-TJOC- PL-XX-DR-C-0085 (see **Figure 3)**.
- All vehicles and plant will be regularly inspected for fuel, oil and hydraulic fluid leaks. Suitable equipment, including spill kits, will be maintained on site to deal with spills.
- It will be ensured that all staff are trained and follow vehicle cleaning procedures. Details of the procedures in the work area will be displayed for easy reference. Use of cleaning chemicals will be minimised.

- Machinery including hand-tools will never be washed in watercourses or drainage ditches or within 50m of same. The location for any washing of machinery will be agreed with the ECoW prior to the commencement of works.

- It will be ensured that all areas where liquids are stored or cleaning is carried out are in a designated impermeable area that is isolated from the surrounding area, e.g. by a roll-over bund, raised kerb, ramps or stepped access.

- Concrete will be poured for the toe and heel protection to the embankment section of the weir and for the core and apron at the mill race weir wall. These activities will be carried out behind sheet piles barriers/ with river flows diverted away

- It is proposed to inject natural cement (also referred to as Prompt) into the fill sections and place mass concrete in the core of the new section of the weir.

- Concrete pouring will not take place during heavy rain when run off is likely due to excess water. Shuttering will be designed to accommodate small increases in the volume of material contained within the shuttered area due to rainfall. Pre-cast concrete will be used if possible. otherwise all cast-in-place concrete shall be isolated from flowing water for a minimum of 48 hours to allow pH to reach neutral levels.

- Wash down and washout of concrete transporting vehicles will not be permitted at the location of construction. Such wash down and washout activities will take place at an appropriate facility offsite or at the location where concrete was sourced.

- A detailed spillage procedure will be put in place and all site personnel will be trained with respect to the relevant procedures to be undertaken in the event of the release of any sediment, hydrocarbons into a watercourse. Spill kits will be maintained on site and relevant staff will be trained in their effective usage. All site personnel will be trained and aware of the appropriate action in the event of an emergency, such as the spillage of potentially polluting substances. In the event of spillage of any polluting substance and/or pollution of a watercourse, CCC, IFI Ireland and the NPWS shall be notified.

- All wastes generated as part of the construction process will be controlled and managed to ensure environmental protection. All site wastes (hazardous and non-hazardous), will be stored in designated areas and taken off-site regularly to prevent large quantities accumulating. Careful ordering of materials will be undertaken to minimise quantities present on-site.

- Wastes which cannot be recycled will be removed from site by a licensed waste contractor to an appropriate licensed landfill facility ensuring adherence to the Environmental Protection (Duty of Care) Regulations 1991.

- Segregated waste for recycling will be removed from site to an appropriate Materials Recycling Facility for reprocessing.

- Where feasible, soil excavation will be completed during dry periods and undertaken with excavators and dump trucks. Topsoil and subsoil will not be mixed together. Topsoil will be stripped in advance of the works but the duration that the works area is

left without topsoil cover will be minimised. Silt fences shall be erected where necessary.

- Stockpiles will be graded to a <1:4 profile. Topsoil and subsoils will be stored separately. Stockpiles of mineral soils and peat will be <2m and <1m respectively. Stockpiles will be covered with plastic sheeting during wet weather to prevent run-off of silt and will be located on flat ground where possible. Excavated material will be used for backfill where possible. Surplus material will be removed from site.

- Stockpiles will be a minimum of 10m from the main Blackwater Channel and will be separated from sensitive aquatic receptors by silt fences (Drawing 19011-TJOC- PL-XX-DR-C-0085 (see **Figure 3**)).

- A dedicated holding tank for storage of construction foul effluent will be constructed prior to commencement of the main construction activities. The effluent will be regularly disposed of off-site by tanker by a licensed contractor to an approved licensed facility.

14.4 Construction Works – Surface Water Management

Any pumping from the works area will discharge to a green vegetated area set back from the river bank to allow for settlement and capture of suspended solids or via silt mitigation measures as specified in the Inland Fisheries Ireland "*Guidelines on Protection of Fisheries During Construction Works In and Adjacent to Water*" (IFI, 2016). Such settlements include lagoon systems and silt tanks discharging through silt socks. These systems will be incorporated into a detailed Water Management System (WMS) which will be prepared by the contractor. This will incorporate the mitigation measures specified by this and other planning documentation and any conditions of planning. The WMS will be drawn up in consultation with the ECoW and will be take into account any changes in river flows or ground conditions which may have occurred subsequent to the submission of this application. The WMS will provide detailed designs for each stage of development and will detail how surface water management will be carried out. The WMS will include the following provisions:

- The design of the WMS will take due consideration of the requirements given in the document "*Control of water pollution from Construction Sites – Guidance for consultants and contractors (Ciria C532*)".

- The WMS shall be contained within the development's site redline boundary.

- Detailed methodologies for the construction of silt management systems (e.g. settlement lagoon, greenfield areas, silt traps, cofferdams, settlement tanks and detailed procedures for pumping water from excavations and from within dammed areas to the relevant silt management systems) will be specified in the WMS.

- Dewatering pumps within excavations will have appropriate capacity to pump out the residual seepage from excavations to maintain the works area excavation dry. The pumps shall be integrated sumps or shall sit on an appropriately sized drip tray which is monitored and emptied regularly. Where required, submersible pumps shall be deployed.

- Pumped flows may contain high levels of silt and there may be possible contamination by hydrocarbons and cement. Thus, these pumped flows must be adequately treated by the WMS prior to discharge to the River Blackwater or other receiving water.

- Detailed contingency plans will be specified to deal with flood events and to manage or remove elements of the development and WMS (i.e., silt fences etc.) which could impact on water quality within the River Blackwater in the event of a severe flood event.

- A detailed water quality monitoring programme will be implemented (See **Section 14.7**).

- All elements of the WMS will be managed and maintained in line with the provisions of a detailed maintenance programme.

- Silt fences will be provided where required between site works and sensitive aquatic receptors. The function of silt fences is to intercept and capture sediment and reduce run-off velocity and erosive. Fences may be single, double or staggered depending on ground conditions. The silt fence layout will allow for vehicles or other equipment to pass and to facilitate maintenance. Silt fences will be in place for each section of works prior to the commencement and must be securely supported with wooden posts. The silt fences will be examined and certified as fit for purpose by the ECoW prior to the commencement of works.

- The WMS will detail emergency procedures to be put in place in the event of fuel spillages.

- Identification of greenfield areas within the redline boundary to which surface water can be discharged. The WMS will ensure that there is sufficient greenfield area available for each section of works and/or will specify alternative means of surface water management.

- To minimise the potential for elevated silt levels in surface water run-off, the working area used during construction will be clearly outlined prior to the commencement of works and will be kept to the minimum area necessary to effectively complete the works.

- Works will be suspended during severe flood events or when such events are forecast. This makes all activities and measures easier to implement and manage and limits the potential for generation of sediment and mobilisation of both sediment and pollutants downstream.

- Works will be carried out in the dry. Temporary measures, including wheel washing facilities and road sweeping, will be provided for the duration of the works in this site to ensure that silt contaminated material is not carried onto the site access tracks or carried into the surface water drainage system. Construction runoff from the works area will be directed through a settlement system prior to discharge.

A site compound will be required for the duration of the works for the storage of materials, plant and equipment, and for a site office(s). It is envisaged that the location of the site compound will be to the west of the proposed Bypass channel (Drawing 19011-TJOC- PL-XX-

DR-C-0085 (see **Figure 3**)). Access to the works on the north bank of the river will require the temporary removal of a section of the railing at the entrance to the triangle (Circus) field. The compound area is identified as being adjacent to the Stage 1 and Stage 2 works areas. A satellite compound/ storage area for the site may be provided for the stage 3 works in the Mill Island carpark with a construction access from there leading to the Stage 3 works area which is located alongside O'Neill Crowley Quay. The Mill Island carpark is in the ownership of the applicant, CCC.

The works will be undertaken within flood defence walls and embankments which comprise the Munster Blackwater Fermoy Drainage Scheme. Therefore, site offices located on a compound within the site on the north bank of the river could be at risk of flooding and would be inaccessible when the flood defence demountable barriers are erected. Therefore, site offices and welfare facilities will be located above the 1% AEP flood level at this location, based on the OPW's flood maps of the area.

14.5 Fish pass works mitigation (within flood plain)

The fish bypass channel is located adjacent to the River Blackwater and within the flood plain.

Because the catchment area of the River Backwater upstream of Fermoy Bridge is approx. 1750km^2 with an average flow of 22.284m^3/s, the risk of flooding of the works must be considered Therefore, the Contractor undertaking the works shall register to receive early warning notification of flood events on the river Blackwater. An early warning system is in place based on river levels at Millstreet. Mobile plant will be removed from potential flood affected areas in the event of a flood warning. Operatives will also be evacuated from that portion of the site and any static plant or temporary works components will be made safe.

14.6 Weir Remediation Works

Weir remediation works will be overseen by the ECoW who will liaise with the contractor prior to the commencement of site works and will evaluate the effectiveness of mitigation measures. In the unlikely event that the mitigation measure do not function as planned during construction, it will be role of the ECoW to supplement the mitigation measures to ensure that they function as planned. Ultimately, the ECoW may decide to halt works until mitigation functions effectively.

- Works will comply with *IFI's Guidelines on protection of fisheries during construction Works in and adjacent to waters* (IFI, 2016).
- In order to maintain flows in the river throughout the weir remediation works, instream construction works will be carried out in two stages i.e. upstream of bridge and downstream of bridge. This will be carried out in the period July to Mid Sept, when river levels are at their lowest in accordance with the "Guidelines on the Protection of Fisheries during Construction Works in or Adjacent to Waters", IFI,2016 (See 19011-TJOC-PL-XX-DR-C-0086 (See **Figure 4**)).
- The construction methods used within the River Blackwater will take into account the preservation of stream flows for movement of fish by ensuring that the sequencing for works allows fish movement for the duration of works.

- The works shall entail the construction of a temporary dam (sheetpiles and sandbags) upstream of the weir on the west side of the bridge, extending from the bridge to the north bank of the river, followed by the creation of a bund and silt fence or proprietary barrier fence extending above the water level in the river, downstream of the weir which would extend across the width of the weir that is located upstream of the bridge.

- Silt movement within the working area will be managed through the use of silt fences which will be disposed of off-site as part of a site clean-up operation prior to the completion of the relevant phase of the works. Sandbags may be required locally to close off any gaps between the elements of the proposed system and at the river banks.

- Sandbagging (damming) must be carefully planned and executed as this carries a risk of negative impacts through generation or introduction of silt and sediment to the river system (if bags burst, for example). Sand-bags (small or 1-tonne) must be clean and of good integrity, preferably fully sealed (i.e., composed of high-grade polythene, not webbing or hessian). Sand-bags must be filled with very clean, coarse grade sand with no fines at all. They need to be carefully handled and placed so they don't burst and no other additional material (like clay or soil etc.) should be introduced to seal gaps. Small (1/4 filled) sandbags should be on hand to seal gaps/leaks in dams as they arise – this will discourage the use of clay or soil to seal gaps.

- A silt curtain will be installed on the river downstream of the section of works to trap any silt generated by the placing or removal of the embankment and downstream of outfalls. The silt curtains will remain until the dam system have been removed and potentially contaminated water enclosed within the dam system has been pumped out to the water management system as approved by the ECoW.

- The requirement for additional silt curtains will be determined by the ECoW based on the contractor's detailed methodology and flow conditions in the river prior to commencement of works.

- Silt curtains shall consist of a continuous filament nonwoven, needle punched, 100% polypropylene, UV stabilised geotextile with the following minimum properties:

    - Characteristic short term tensile strength = 31kN/m;
    - Elongation at characteristic short term strength (md/cd) = 80/50 %
    - CBR puncture strength = 5200N
    - Effective opening size (O90) = 0.08mm
    - Vertical water flow (50mm head) = 42 l/m²/s
    - Mass per unit area = 500g/m²

- Each individual silt fence or curtain panel shall be joined together by the use of high strength nylon rope. An overlap of 500mm shall be provided between each adjacent panel and threaded continuously together along the whole length with nylon rope to prevent piping of pollutant. The silt curtain shall be attached to a HDPE float for

buoyancy and a steel chain weight fixed along the bottom of the silt curtain, with the size and weight of these determined by the silt curtain supplier. Appropriately sized and spaced concrete blocks shall also be used to anchor the HDPE float in position.

- The silt curtain shall initially be installed as close as possible to the proposed works and then moved from here into its required position to prevent fish being trapped behind it. The Contractor shall carefully choose the type and depth of silt curtain to ensure it is not damaged / swept away during flood conditions. Maintenance will be carried out daily.

- Fish will be removed from the area of river within the barriers and dams and within any silt curtain or sandbag envelope. This activity will be undertaken by personnel authorised by IFI and the EcOW.

- The optimum time for undertaking the works is from July to mid-September when river levels should be at their lowest and the risk of fluvial flooding would be low. In the event of a significant flood warning, the contractor will be obliged to breach the temporary barriers/dams in order to reduce the risk of the embankment contributing to increased flood risk.

14.7 Monitoring

The following measures are to be adopted with regards to silt monitoring:

- Sampling of the River Blackwater to establish a suitable baseline for Suspended Solids and Turbidity

- Determining a relationship between Suspended solids and Turbidity. This is to allow monitoring of Suspended Solids levels by monitoring Turbidity levels

- Specification of suitable trigger levels for Suspended Solids and equivalent Turbidity levels, for a traffic light system (green/continue, amber/caution, red/stop), in response to monitoring of Turbidity levels during the works.

- Monitoring of Suspended solids or turbidity during the works, including monitoring of Natural Turbidity levels prior to start of works each day, so that comparison each day can be related to Naturally occurring levels on the day, rather than a possibly exceptionally low baseline.

- Ensure temporary suspension of the works, if silt levels are excessive (above the predetermined thresholds), or if the silt curtains rupture or otherwise fail.

- Provision for further measures that may be implemented, as appropriate, if silt levels become increase above threshold level, such as, changing the work that is ongoing at the time, implementing additional silt control measures such as straw bales, suspending the work for a period to allow the river run clear.

- Modification of silt curtain location as the works vary, to suit the works

- Employ a specialist for guidance on the advice with regard to the use of silt curtains.

- Provide for ongoing engagement with IFI on the issue of construction methodologies, silt control and threshold levels.

14.8 Lighting

Potentially construction lighting associated with the site works could cause disturbance/displacement of Otter and bat species. Artificial lighting at night has the potential to disrupt and disorientate fish and increase exposures to predation. If of sufficient severity and duration, there could be impacts on reproductive success.

Site lighting will typically be provided by tower mounted temporary portable construction floodlights. The floodlights will be cowled and angled downwards to minimise spillage to surrounding habitats. The following measures will be applied in relation to site lighting:

- Lighting will be provided with the minimum luminosity sufficient for safety and security purposes. Where practicable, precautions will be taken to avoid shadows cast by the site hoarding on surrounding footpaths, roads and amenity areas;
- Lights will be switched off when not in use; and
- Lighting will be positioned and directed so that it does not to unnecessarily intrude on adjacent ecological receptors and structures used by protected species. The primary area of concern is the potential impact on the treelines/riparian vegetation and the River Blackwater along the southern boundary of the site. There will be no directional lighting focused outside the working area within the River Blackwater or boundary habitats respectively and cowling and focusing lights downwards will minimise light spillage.
- Works will primarily take place during hours of daylight to minimise disturbance to any nocturnal mammal species.

14.9 Hours of Work

The hours of construction work and site deliveries, unless otherwise amended by the Planning Authority, will be restricted to the following:

• _Monday to Friday 0700hrs to 1900hrs

• _Saturday 0700hrs to 1400hrs

• _Sunday and Bank Holidays Works prohibited

• _Deliveries (of materials, plant or machinery) 0800hrs to 1900hrs

There may be occasions where it is necessary to make certain deliveries outside these times, for example, where large loads are limited to road usage outside peak times.

14.10 Noise

The development site is located in an urban setting. Background noise levels are expected to be elevated during daytime hours. The principle sources of noise emissions from the site will be: -

- During the site clearance phase
- During excavation works.
- General construction activity, including deliveries to / from the site, use of power tools etc.
- Sheet piling for weir remediation works and fish bypass channel

To minimise nuisance caused by noise from the construction, excavation and demolition (C&D) works, the contractor will be required to implement noise control measures in accordance with the requirements of British Standard BS5228 'Noise Control on Construction on Open Sites, Part 1 – Code of Practice for basic information and procedures for noise control'. In this regard, the contractor will be required to ensure that noise levels from the C&D activities on site are within acceptable limits.

The potential for any item of plant to generate noise will be assessed prior to the item being brought onto the site. The least noisy item should be selected.

If replacing a noisy item of plant is not a viable or practical option, consideration will be given to noise control "at source". This refers to the modification of an item of plant or the application of improved sound reduction methods in consultation with the supplier. For example, resonance effects in panel work or cover plates can be reduced through stiffening or application of damping compounds; rattling and grinding noises can often be controlled by fixing resilient materials in between the surfaces in contact.

Mobile plant will be switched off when not in use and will not be left idling.

All items of plant will be subject to regular maintenance. Such maintenance can prevent unnecessary increases in plant noise and can serve to prolong the effectiveness of noise control measures.

14.11 Habitats

All personnel involved with the project will receive an on-site induction relating to operations and the environmentally sensitive nature of Natura 2000 sites and the proximity of aquatic habitats.

The Wildlife Amendment Act 2000 (S.46.1) provides that it is an offence to cut, grub, burn or destroy any vegetation on uncultivated land or such growing in any hedge or ditch from the first of March to the 31st of August. Exemptions include the clearance of vegetation in the course of road or other construction works or in the development or preparation of sites on which any building or other structure is intended to be provided. None the less it is recommended that vegetation be removed outside of the breeding season where possible. In particular, removal during the peak-breeding season (April-June inclusive) will be avoided. Such a timeframe would also minimise the potential disturbance of breeding birds outside of the proposed development site boundary. If works are carried out during the breeding season, a preconstruction survey will be carried out by the EcOW who will specify appropriate mitigation.

The works will be identified and will be securely fenced and sign posted early in the construction phase. These will be clearly visible to machine operators.

All trees/hedgerows to be retained to be protected in accordance with BS 5837:2012, Trees in relation to design, demolition & construction. Prior to the commencement of any work, or any materials being brought on site, existing trees to be retained are to be protected with temporary fencing. This shall be maintained in good and effective condition until the work is completed. Allow for stabiliser struts to secure fence for duration of construction. Fully remove when construction is complete/site demobilised.

Significant crown reduction is likely to be required for retained Black Poplar to ensure their stability and survival once the other trees have been removed. The extent of crown reduction will be specified by the arboricultural consultant following removal of adjoining trees.

The protective fencing is to coincide, as far as is practical, with the root protection area (rpa), unless otherwise agreed. all weather notices shall be securely fixed to the fence words such as 'construction exclusion zone - no access (See **Appendix 4**)

The following measures are particularly important:

- Materials are never to be stacked within the root spread of the tree;
- No oil, tar, bitumen, cement or other material is to be allowed to contaminate the ground;
- No fires shall be lit beneath or in close proximity to the tree canopy;
- Trees to be retained should not be used as anchorages for equipment or for removing stumps
- Root Protection Area (RPA) Outside tree canopy dripline roots or other trees, or for other purposes;
- No notices, telephone cables or other services should be attached to any part of the tree;
- Cement mixing should not be carried out within the canopy/protected area of the tree;
- Rails clamped securely to posts
- Soil levels are to be maintained as existing within the root spread of the tree. Any alteration to soil levels in an area up to one and a half times the diameter of the tree canopy must be agreed with the ER/Architect.

Grassland area that are damaged and disturbed will be left to regenerate naturally or will be rehabilitated and landscaped with standard seed mixtures. The ECoW will specify suitable new grassland mixes, including native species mixes which are available from specialist suppliers, depending on the ground conditions post construction. A detailed landscape plan has been included with this application which outlines replacement tree planting within the footprint of the fish bypass channel (See **Section 3.4**).

To protect stream side vegetation from damage, where access is required to the river, the supervising ECoW will identify areas where construction activity is not necessary and will ensure these areas are securely fenced.

Standard mitigation will be implemented as part of a dust minimisation plan to minimise potential impact on terrestrial and aquatic habitats.

14.12 Otter

An Otter holt was recorded approximately 300m east of the weir during June and July 2020. A pre-construction Otter survey, including the use of camera traps, will be carried out prior to the commencement of works to ascertain if this holt is still being used and to determine if new holts, couches or resting areas have become established in the intervening period. A derogation licence will be sought for the instream works in relation to Otter couches based on the results if the up to date Otter surveys. It is noted that the Otter holt recorded during site surveys is located a considerable distance from site works and therefore a licence in relation to this holt is not considered necessary.

Any holts found to be present by up to date surveys prior to construction will be subject to monitoring and mitigation as set out in the NRA *Guidelines for the Treatment of Otter prior to the Construction of National Road Schemes* (2006). If found to be inactive, exclusion of holts may be carried out during any season. No wheeled or tracked vehicles (of any kind) will be used within 20m of active, but non-breeding, Otter holts. Light work, such as digging by hand or scrub clearance will also not take place within 15m of such holts, except under license. The prohibited working area associated with Otter holts will be fenced and appropriate signage erected. Where breeding females and cubs are present no evacuation procedures of any kind will be undertaken until after the Otters have left the holt, as determined by an ecologist. Breeding may take place at any season, so activity at a holt must be adjudged on a case by case basis.

The ECoW will ensure that there are no impediments to prevent free movement of Otters, for example, between different feeding areas or between holts and a feeding area. The provisions required, which may include leaving gaps in fencing will be specified by the ECoW based on a preconstruction survey.

14.13 Bats

During the site works, general mitigation measures for bats will follow the National Road Authority's '*Guidelines for the Treatment of Bats during the Construction of National Road Schemes'* NRA (2005c) and *'Bat Mitigation Guidelines for Ireland: Irish Wildlife Manuals, No. 25*' (Kelleher, C. & Marnell, F. (2006)). These documents outline the requirements that will be met in the pre-construction (site clearance) stage to minimise negative effects on roosting bats, or prevent avoidable effects resulting from significant alterations to the immediate landscape.

The contractor will take all required measures to ensure works do not harm individuals by altering working methods or timing to avoid bats, if necessary. The following mitigation measures will be implemented:

- A Pre-construction survey by the ECoW will be carried out prior to tree felling or crown reduction
- The ECoW will work with the contractor to ensure that crown reduction on trees in minimised and that trees earmarked for retention are adequately protected.
- Tree-felling and crown reduction will be undertaken in the period September to late October/early November. During this period bats are capable of flight and may avoid the risks of tree-felling if proper measures are undertaken.
- Felled trees will not be mulched immediately. Such trees will be left lying several hours and preferably overnight before any further sawing or mulching. This will allow any bats within the tree to emerge and avoid accidental death. The bat specialist will be on-hand during felling operations to inspect felled trees for bats. If bats are seen or heard in a tree that has been felled, work will cease and the local NPWS Conservation Ranger will be contacted.
- Tree will be retained where possible and no 'tidying up' of dead wood and spilt limbs on tree specimens will be undertaken unless necessary for health and safety.
- Treelines outside the proposed development area but adjacent to it and thus at risk, will be clearly marked by a bat specialist to avoid any inadvertent damage.
- During construction directional lighting will be employed to minimise light spill onto adjacent areas. No directional lighting will be focused towards riparian habitat and cowling and focusing lights downwards will be utilised to minimise light spillage.
- If bats are recorded by the bat specialist within any vegetation or structure on site i.e. trees, or walls to be removed or impacted on, no works will proceed without a relevant derogation licence from the NPWS.
- As a bio-enhancement measure six bat boxes will be provided. The location of the bat boxes will be agreed between the ECoW and contractor.

14.14 Birds

A pre-construction bird survey will be carried out prior to the commencement of works. This survey will focus on Kingfisher which is an Annex I species under the EU Birds Directive.

If nests (of any bird species) are recorded within the works area, suitable mitigation measures will be implemented to prevent impacts to breeding birds.

14.15 Invasive species

- A survey for invasive species will be carried out prior to the commencement of works. This is to confirm the extent of infestations as identified by invasive species surveys to date, and to determine whether any new infestations have established in the intervening period. An Invasive species management plan (ISMP) is attached as **Appendix 5**. This will be updated by an invasive species specialist based on up-to-date survey data prior to the commencement of site works,

- To prevent Japanese Knotweed or other invasive species from outside the site being inadvertently being brought into the site, the contractor will be required to inspect, clean and wash down vehicles within a specific area within the site compound before using them on site.

- Prior notification will be given to all contractors that parts of the site are contaminated with Japanese knotweed and that they must adhere to this protocol to avoid the spread of the plant within and more importantly, outside of the works area. This includes any site investigation works in advance of commencement of excavation works.

- All stands of Japanese knotweed will be clearly delineated with hazard tape in a manner visible to machine operators prior to the commencement of works.

- Appropriate signage will be put in place to deter any entrance by people or machinery into the areas within which the Japanese knotweed is growing.

- A buffer zone of at least seven metres should be put in place in respect to the stand of Japanese Knotweed. This zone should be clearly marked/fence and no works should proceed within these buffer zones.

- Where direct disturbance within 7m of a stand of Japanese Knotweed is unavoidable then an invasive species management plan will be drawn up to ensure that risks are minimised. This includes any site investigation works which may proceed the commencement of site works. This management plan should include all provisions for site hygiene and appropriate disposal of contaminated soil and subsoil.

- Only vehicles required for the works within the contaminated works area should be brought on site and the number of visits minimised as much as practicable. Vehicle movements within this area should be kept a minimum. A specialised wash down area will be created for machinery and footwear. All machinery and equipment (including footwear) should be power washed prior to leaving the contaminated works area within this wash down area. They should also be visually checked for clods of soil, bits of vegetation etc. and particular care is required with tracked machinery. This wash down area will be located in close proximity to existing stands and the wash down area will be included in the post-works treatment programme for Japanese knotweed.

- Any excavation within the contaminated area should be carried out under the supervision of a qualified ecologist who can identify rhizomes and ensure they are removed if present.

- If Japanese knotweed contaminated material is to be removed off site it will require a licence from the National Parks and Wildlife Service in advance of any removal, in accordance with the European Communities (Birds and Natural Habitats) Regulations 2011 (SI 477).

- Any Himalayan Balsam within the works will be hand-pulled and bagged prior to the commencement or site works. It will be then placed in a designated area of the site to decay. The seeds are not particularly robust but may survive for 18 months so a two-year programme of control, which will extend beyond the construction period, will be required. All machinery leaving the site will be washed down in a designated wash

down area in proximity to the site exit to prevent seeds from being spread outside the site boundary.

- If and where contaminated soil or heaps of high-risk invasive species (i.e. Himalayan Balsam) are to be stockpiled, the area will be clearly marked out on site. These areas will preferably not be within 20m of any watercourse or flood zone.
- Post development any Amber Listed invasive species remaining on the site will be treated via a standard herbicide programme. Herbicides must be used according the manufacturers recommendations and must be suitable for use near watercourses.

Full details on invasive species control measures are outlined in the ISMP (**Appendix 5**).

14.16 Crayfish

A survey for this species will be carried out within the proposed crossing area prior to the commencement of works and any individuals recorded will be relocated outside the works area under a derogation licence from NPWS.

Prior to construction delimiting areas where construction activity is not necessary and which is to remain off-limits and undisturbed will be outlined by the supervising ECoW and securely marked up on contractor maps and where possible marked out or fenced on site. This species was recently recorded in crevices in proximity to Fermoy Weir and may occur within the works area in eroded crevices.

A trapping programme will be implemented to ensure that any Crayfish within this area are removed prior to the commencement of works. Up to twenty 'Trappy Funnel Crayfish Traps' ballasted with extra rock will be positioned in the footprint of instream works areas during each trapping episode.

If flows are too high to remove crayfish prior to commencement of site works then it may be necessary to remove crayfish once the temporary dam is in place. The ECoW will check for crayfish on an ongoing basis during site works and translocated as necessary. A second translocation area will be located adjacent to Fermoy Slipway as agreed with NPWS. The Section 23 and 24 license to capture and translocate White Clawed Crayfish has been received from NPWS.

It is noted that rock armour is likely to provide suitable refuges for White Clawed Crayfish and this species is likely to recolonise this area after works are complete.

14.17 Fish

Construction activities will be limited to daylight hours where possible and will minimise night working when main surges of migratory fish are more likely to occur.

There is the potential for direct impacts on fish species including species such as Atlantic Salmon and Brook Lamprey to become trapped within silt curtain envelopes. Other species such as European Eel, Brown Trout and Dace may also be affected. Where necessary an electrofishing salvage operation will be carried out (by IFI or by EcOW) to remove any fish that become enclosed within the works area. This will ensure that there will be no significant direct effects on fish species.

14.18 Biosecurity

Crayfish Plague is caused by a fungus-like organism *Aphanomyces astaci* which is of North American origin but now occurs throughout Europe. The Crayfish Plague organism (technically an Oomycete and often called water moulds) normally grows on the outer shell of crayfish and North American crayfish are generally immune to it, as they can prevent any infection reaching their body tissues. However, when the water mould infects White-clawed and other European crayfish, it rapidly, and fatally, spreads into the body tissues. Infected animals become distressed and behave abnormally and may survive several weeks before dying.

Crayfish occur within the Blackwater system and establishment of the disease crayfish plague can have highly detrimental impacts on this species. Throughout its European range, this species has been decimated by the impact of Crayfish plague disease which spread to Europe with the introduction of the plague carrier North American species of crayfish. Therefore, as recommended by the Inland Fisheries Ireland a Check, Clean and Dry protocol should be utilised.

- All wet gear or machinery which has previously come into contact with watercourses should be checked for any silt or mud, plant material or animals. It then should be cleaned and finally dried. Disinfectant or hot water (over 65ºC) should be used to clean all equipment followed by a 24hr drying period. This should be adopted as standard practice in all freshwaters. This will be incorporated into a detailed Biosecurity Management Plan which will be prepared by the contractor and approved by the ECoW prior to the commencement of site works. The Biosecurity Management Plan will take into account up do date information with respect to biosecurity risks.

- Stringent biosecurity measures will be implemented throughout the works following the OPW's Invasive Species Procedures. The best practice principles of Check-Clean-Dry guidance of the Non-Native Species Secretariat (NNSS, 2017), IFI biosecurity protocols (IFI,2010) and Waterways Ireland Marine Notice No. 39/2017 shall be followed during these works, to ensure that crayfish plague and invasive non-native species are not introduced into the proposed working area.

14.19 Fish bypass channel monitoring

The DVWK guidance suggests that the characteristics of irregular rough-channel pool passes cannot be calculated accurately and that a degree of testing and modification should be allowed for during the construction phase. Therefore, testing and modification will be carried out during the construction phase in agreement with IFI. If it is determined that slight modifications are required e.g. perturbance boulders these will be agreed with IFI prior to implementation.

Flows within the fish bypass channel and at the entrance and exit points will be monitored during the operational phase to ensure that the bypass channel is operating as designed and meets the velocity requirements for various fish species.

Where significant accumulations of debris occur during operation of the fish bypass channel, these will be removed on an ongoing basis.

Post construction monitoring of the efficacy of the fish bypass channel for the various target species was recommended (particularly for Twaite Shad) by the independent review RKDVH. The following operational monitoring will be carried out.

- eDNA methods have been proposed as the most effective solution given the catchment location of the fish pass, the range of target fish with distinct life history traits and behaviours, and catchment size.
- A meta-barcode all-species approach is proposed, although at a minimum shad and lamprey species should be included.
- A baseline will be established, with post operational monitoring to extend to ten years.
- An opportunity to include Freshwater Pearl Mussel (FPM) within the eDNA monitoring programme exists.

15. Conclusions

In respect of terrestrial habitats, the development will result in the nett loss of amenity grassland and a small number of trees which could be used as nesting habitats for common bird species. The landscape plan includes native tree planting, a riparian enhancement area as well as a Willow treeline along the northern and southern boundary of the fish bypass channel. Essentially the tree planting will provide a high quality, alternative treeline connecting to treelines to the east and west of the proposed development site. In the medium to long-term this will provide a foraging/commuting route for bats and prevent the loss of connectivity with other foraging areas along this area of the River Blackwater. In the long-term these trees are likely to provide roosting sites for local bat populations. No significant bat roosts will be affected and additional bat boxes will be provided.

While there will be temporary loss of aquatic habitats during construction, there will no long-term loss of aquatic habitats within the River Blackwater. The direct loss of aquatic habitats will be minimal and largely confined to the existing weir where there will be some loss of potential niches for White Clawed Crayfish associated with the remediation works. It is noted that the surface of remediated weir will be cobbled, without pointing of joints, creating some opportunity for crevices for crayfish. White-clawed Crayfish range is expanding within the overall catchment and there is considerable alternative habitat available with the Blackwater catchment. Individual crayfish will be captured an relocated prior to the commencement of works.

Detailed mitigation measures have been specified to minimise impacts on aquatic ecology. This includes measures to carry out works in the dry, seasonal restrictions, active measures for the control of silt, adequate storage of hydrocarbons and other chemicals, careful sequencing of the proposed works, measures to deal with flood events and ecological supervision of the proposed works. Any impacts on water quality will be localised and temporary and will not have a significant impact on aquatic ecology.

The provision of the fish pass which has been specifically designed to allow for the passage of all relevant fish species will have a net positive impact by facilitating fish movement within the river. The proposed fish bypass channel will be more effective than the existing fish ladder as the water velocities associated with the current breach in the weir are too fast to allow

effective fish migration. Electrofishing will be utilised as part of a fish salvage operation to ensure there are no significant direct impacts on fish during construction, Overall therefore the proposed development will have a net positive impact on fish populations in the medium to long term.

Noise and disturbance levels will increase during construction. However works will take place within an urban environment and the increase in noise and disturbance during construction is not predicted to be significant.

Specific measures will be implemented to ensure that no spread of invasive species will occur and that the works to not result in the introduction of crayfish plague.

As no significant impacts on water quality are predicted to occur and subsequently there will be no impact on pNHAs downstream of the proposed development site. A NIS submitted with this application concluded that following the implementation of mitigation measures, the proposed development will have no significant impact on the integrity of Natura 2000 sites.

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Appendices

Appendix 1. NRA 2009 Guidelines

Table 1: Examples of valuation at different geographical scales

Ecological valuation: Examples

International Importance:

- 'European Site' including Special Area of Conservation (SAC), Site of Community Importance (SCI), Special Protection Area (SPA) or proposed Special Area of Conservation.
- Proposed Special Protection Area (pSPA).
- Site that fulfills the criteria for designation as a 'European Site' (see Annex III of the Habitats Directive, as amended).
- Features essential to maintaining the coherence of the Natura 2000 Network.[4]
- Site containing 'best examples' of the habitat types listed in Annex I of the Habitats Directive.
- Resident or regularly occurring populations (assessed to be important at the national level)5 of the following:
    - Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive; and/or
    - Species of animal and plants listed in Annex II and/or IV of the Habitats Directive.
- Ramsar Site (Convention on Wetlands of International Importance Especially Waterfowl Habitat 1971).
- World Heritage Site (Convention for the Protection of World Cultural & Natural Heritage, 1972).
- Biosphere Reserve (UNESCO Man & The Biosphere Programme).
- Site hosting significant species populations under the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals, 1979).
- Site hosting significant populations under the Berne Convention (Convention on the Conservation of European Wildlife and Natural Habitats, 1979).
- Biogenetic Reserve under the Council of Europe.
- European Diploma Site under the Council of Europe.
- Salmonid water designated pursuant to the European Communities (Quality of Salmonid Waters) Regulations, 1988, (S.I. No. 293 of 1988).[6]

National Importance:

- Site designated or proposed as a Natural Heritage Area (NHA).
- Statutory Nature Reserve.
- Refuge for Fauna and Flora protected under the Wildlife Acts.
- National Park.
- Undesignated site fulfilling the criteria for designation as a Natural Heritage Area (NHA);
- Statutory Nature Reserve; Refuge for Fauna and Flora protected under the Wildlife Act; and/or a National Park.
- Resident or regularly occurring populations (assessed to be important at the national level)7 of the following:
    - Species protected under the Wildlife Acts; and/or
    - Species listed on the relevant Red Data list.
- Site containing 'viable areas'[8] of the habitat types listed in Annex I of the Habitats Directive.

County Importance:

- **Area of Special Amenity.[9]**
- **Area subject to a Tree Preservation Order.**
- **Area of High Amenity, or equivalent, designated under the County Development Plan.**
- **Resident or regularly occurring populations (assessed to be important at the County level)[10] of the following:**
    - **Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive;**
    - **Species of animal and plants listed in Annex II and/or IV of the Habitats Directive;**
    - **Species protected under the Wildlife Acts; and/or**
    - **Species listed on the relevant Red Data list.**
- **Site containing area or areas of the habitat types listed in Annex I of the Habitats Directive that do not fulfil the criteria for valuation as of International or National importance.**
- **County important populations of species, or viable areas of semi-natural habitats or natural heritage features identified in the National or Local BAP, 11 if this has been prepared.**

- **Sites containing semi-natural habitat types with high biodiversity in a county context and a high degree of naturalness, or populations of species that are uncommon within the county.**
- **Sites containing habitats and species that are rare or are undergoing a decline in quality or extent at a national level.**

Local Importance (higher value):

- Locally important populations of priority species or habitats or natural heritage features identified in the Local BAP, if this has been prepared;
- Resident or regularly occurring populations (assessed to be important at the Local level)12 of the following:
    - Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive;
    - Species of animal and plants listed in Annex II and/or IV of the Habitats Directive;
    - Species protected under the Wildlife Acts; and/or
    - Species listed on the relevant Red Data list.
- Sites containing semi-natural habitat types with high biodiversity in a local context and a high degree of naturalness, or populations of species that are uncommon in the locality;
- Sites or features containing common or lower value habitats, including naturalised species that are nevertheless essential in maintaining links and ecological corridors between features of higher ecological value.

Local Importance (lower value):

- Sites containing small areas of semi-natural habitat that are of some local importance for wildlife;
- Sites or features containing non-native species that are of some importance in maintaining habitat links.

4 See Articles 3 and 10 of the Habitats Directive.
5 It is suggested that, in general, 1% of the national population of such species qualifies as an internationally important population. However, a smaller population may qualify as internationally important where the population forms a critical part of a wider population or the species is at a critical phase of its life cycle.
6 Note that such waters are designated based on these waters' capabilities of supporting salmon (*Salmo salar*), trout (*Salmo trutta*), char (*Salvelinus*) and whitefish (*Coregonus*).
7 It is suggested that, in general, 1% of the national population of such species qualifies as a nationally important population. However, a smaller population may qualify as nationally important where the population forms a critical part of a wider population or the species is at a critical phase of its life cycle.
8 A 'viable area' is defined as an area of a habitat that, given the particular characteristics of that habitat, was of a sufficient size and shape, such that its integrity (in terms of species composition, and ecological processes and function) would be maintained in the face of stochastic change (for example, as a result of climatic variation).
9 It should be noted that whilst areas such as Areas of Special Amenity, areas subject to a Tree Preservation Order and Areas of High Amenity are often designated on the basis of their ecological value, they may also be designated for other reasons, such as their amenity or recreational value. Therefore, it should not be automatically assumed that such sites are of County importance from an ecological perspective.
10 It is suggested that, in general, 1% of the County population of such species qualifies as a County important population. However, a smaller population may qualify as County important where the population forms a critical part of a wider population or the species is at a critical phase of its life cycle.
11 BAP: Biodiversity Action Plan
12 It is suggested that, in general, 1%of the local population of such species qualifies as a locally important population. However, a smaller population may qualify as locally important where the population forms a critical part of a wider population or the species is at a critical phase of its life cycl

Appendix 2. Aquatic baseline report for Fermoy Weir, Fermoy, Co. Cork

Aquatic baseline report for Fermoy Weir, Fermoy, Co. Cork

Prepared by Triturus Environmental Ltd. for

DixonBrosnan Environmental Consultants

May 2021

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Table of contents

1. Introduction

1.1 Background

Triturus Environmental Ltd. were contracted by DixonBrosnan Environmental Consultants (on behalf of Cork County Council) to undertake a baseline aquatic survey of the (Munster) River Blackwater in the vicinity of Fermoy Weir, Fermoy, Co. Cork.

The survey was undertaken to establish baseline aquatic and fisheries data used in the preparation of the Environmental Impact Assessment Report (EIAR) and Natura Impact Statement (NIS) for the proposed instream works on the River Blackwater (EPA code: 18B02). Works included the construction of a new fish pass structure (rock ramp) and repairs to the existing weir. The survey area, both upstream and downstream of Kent Bridge and the existing weir, was located in the Blackwater River SAC (site code: 002170) and also within the River Blackwater *Margaritifera* sensitive area (**Figure 2.1**).

The baseline survey was undertaken to establish the importance of the River Blackwater at Fermoy Weir in supporting qualifying interest species and habitats for the Blackwater River SAC (site code: 002170) (NPWS, 2012). The ecological surveys included detailed assessments of fisheries (including both salmonid and lamprey habitat), white-clawed crayfish (*Austropotamobious pallipes*), freshwater pearl mussel (*Margaritifera margaritifera*) and biological water quality (macro-invertebrates). An otter (*Lutra lutra*) survey was undertaken to identify any breeding or resting areas for the species in the vicinity of the proposed works. The surveys also considered the importance of the survey area in supporting the qualifying interest Annex I habitat 'Water courses of plain to montane levels, with submerged or floating vegetation of *Ranunculion fluitantis* and *Callitricho-Batrachion* or aquatic mosses [3260]' and non-qualifying interest Annex I habitat 'Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels [6430]'.

1.2 Project description

A full description of the proposed works for the Fermoy Weir project are described in the accompanying EIAR for the project.

2. Methodology

2.1 Desktop review

A desktop review was undertaken to collate and review available information, datasets and documentation sources pertaining to the natural environment of the aquatic survey area. Records available on the National Biodiversity Data Centre (NBDC) website were reviewed.

A sensitive species data request for terrestrial and aquatic flora and fauna covering the 10km grid squares adjoining and containing the proposed River Blackwater works area (i.e. W79 & W89) was requested from the Department of Culture, Heritage and the Gaeltacht on Tuesday 28th July 2020 and received on 4th August 2020.

2.2 Walkover surveys

Site visits of the aquatic survey area were conducted on Tuesday 26th May, Monday 8th June, Thursday 9th and Sunday 26th July 2020 by Triturus Environmental Ltd. Survey sites were assessed in light of the proposed works, with survey effort focused on both instream and riparian habitats upstream and downstream of the existing weir. Aquatic surveys included a fisheries assessment (electro-fishing, see section 2.3 below and **Appendix A**), fisheries habitat appraisal, shad species eDNA analysis and a white-clawed crayfish assessment. A freshwater pearl mussel survey was also undertaken by Sweeney Consultancy in the vicinity of Fermoy Weir (see section 2.6 and **Appendix B).** A macrophyte survey was undertaken to establish the presence of the Annex I habitats 'Water courses of plain to montane levels, with submerged or floating vegetation of *Ranunculion fluitantis* and *Callitricho-Batrachion* or aquatic mosses [3260]' and ''Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels [6430]'. Additionally, biological water quality (Q-sampling) was undertaken at *n*=4 sites (two upstream and two downstream of Fermoy Weir, **Figure 2.2**). An otter survey was undertaken to identify any breeding or resting areas for the species in the vicinity of the proposed works, in addition to other signs (e.g. spraint) which would help to establish the species' utilisation of the area (i.e. foraging and commuting).

A broad aquatic habitat assessment was conducted at each site utilising elements of the methodology given in the Environment Agency's *'River Habitat Survey in Britain and Ireland Field Survey Guidance Manual 2003*' (EA, 2003) and the Irish Heritage Council's *'A Guide to Habitats in Ireland*' (Fossitt, 2000). All sites were assessed in terms of:

- Channel width, depth profile and other physical characteristics.
- Substrate type, listing substrate fractions in order of dominance, i.e. bedrock, boulder, cobble, gravel, sand, silt etc.
- Flow type, listing percentage of riffle, glide and pool in the sampling area
- In-stream macrophyte and aquatic bryophytes occurring and their percentage coverage of the river bed at the sampling sites
- Riparian vegetation composition

The River Blackwater was divided into discrete survey sections to help provide focus on the distribution of species and habitats of conservation value relative to the proposed works. In this respect, a total of *n*=5 sections were surveyed (A to E; **Table 2.1, Figure 2.1**).

Table 2.1 Aquatic survey site locations in the footprint of the Fermoy Weir works, Fermoy, Co. Cork.

Section	Watercourse	EPA code	Location	ITM (x)	ITM (y)
A	River Blackwater	18B02	100-200m upstream of Fermoy Weir	581014	598585
B	River Blackwater	18B02	0-100m upstream of Fermoy Weir	581117	598574
C	River Blackwater	18B02	0-100m downstream of Fermoy Weir	581202	598603
D	River Blackwater	18B02	100-200m downstream of Fermoy Weir	581313	598683
E	Mill-race channel	n/a	O'Neill-Crowley Quay	581300	598591

2.3 Aerial drone surveys

To further inform the walkover surveys and ensure the most contemporary mapping data was available for aquatic baseline surveys, an aerial fixed-wing drone survey was undertaken of the wider Fermoy Weir site in June 2020. A flight plan was specifically tailored to meet the needs of the project. The drone was programmed to fly at 120m elevation (Irish Aviation Authority regulated height), capturing high resolution imagery at a rate of 2cm per pixel with absolute accuracy of between 2-4cm (RTK activated). In order to capture a single ortho-mosaic, multiple images were taken and subsequently stitched together in post-processing to produce a single geo-referenced image of the entire study area (i.e. 100m upstream and downstream of the extent of the existing weir). Imagery was captured during calm, bright conditions (on the same day as the SONAR survey, see below) which allowed for the highest resolution and greatest level of detail.

2.4 SONAR survey

To determine the bathymetry and substrata-type (i.e. bottom hardness and rugosity[1]) within the survey sections of channel, a SONAR survey was undertaken during July 2020. Primarily, this approach helped to estimate the extent of and elucidate any potential (soft sediment) larval lamprey areas. The bottom hardness mapping also helped to inform the location of potential ammocoete burial habitat in poorly-accessible deeper water zones (i.e. >1.6m in depth). A Lowrance Elite 9HDS-Live SONAR unit was mounted on a 3m RIB equipped with a total-scan transducer to log bathymetry and bottom hardness and rugosity. Reefmaster v2.0 software was used to generate point clouds for map creation in ArcGIS v10.8.

[1] Rugosity is a 3-D measure of the topographic roughness or complexity of riverbed substrata (Brasington et al., 2012)

2.5 Fisheries assessment (electro-fishing)

Triturus Environmental Ltd. made an application under Section 14 of the Fisheries (Consolidation) Act, 1959 as substituted by Section 4 of the Fisheries (Amendment) Act, 1962, to undertake an electro-fishing survey (*n*=5 sites; see **Table 2.1, Figure 2.1**) in the footprint of the proposed Fermoy Weir works. Permission was granted on Monday 29th June 2020 and the survey was undertaken Thursday 9th July 2020 following notification to Inland Fisheries Ireland (Macroom).

A single anode Smith-Root LR24 backpack (12V DC input; 300V, 100W DC output) was used to electro-fish sites on the River Blackwater in the footprint of the proposed Fermoy Weir works on Thursday 9th July 2020, following notification to Inland Fisheries Ireland (Macroom) and under the conditions of a Department of Communications, Climate Action & Environment (DCCAE) licence. Both river and holding tank water temperature was monitored continually throughout the survey to ensure temperatures of 20°C were not exceeded, thus minimising stress to the captured fish due to low dissolved oxygen levels. A portable battery-powered aerator was also used to further reduce stress to any captured fish contained in the holding tank. Salmonids, European eel and other captured fish species were transferred to a holding container with oxygenated fresh river water following capture. To reduce fish stress levels, anaesthesia was not applied to captured fish. All fish were measured to the nearest millimetre and released in-situ following a suitable recovery period.

As three primary species groups were targeted during the survey, i.e. salmonids, lamprey, and eel, the electro-fishing settings were tailored for each species. By undertaking electro-fishing using the rapid electro-fishing technique (see methodology below), the broad characterisation of the fish community at each sampling reach could be determined as a longer representative length of channel can be surveyed. Electro-fishing methodology followed accepted European standards (CEN, 2003) and adhered to best practice (e.g. CFB, 2008).

2.5.1 Salmonids and European eel

For salmonid species and European eel, as well as other incidental species, electro-fishing was carried out in an upstream direction for a 10-minute CPUE, an increasingly common standard approach for wadable streams (Matson et al., 2018). A total of approx. ≥50-75m channel length was surveyed at each site, where feasible, in order to gain a better representation of fish stock assemblages.

Relative conductivity of the water at each site was checked in-situ with a conductivity meter and the electro-fishing backpack was energised with the appropriate voltage and frequency to provide enough draw to attract salmonids and European eel to the anode without harm. For the moderate conductivity waters of the River Blackwater, a voltage of 250-275v, frequency of 45Hz and pulse duration of 3.5ms was utilised to draw fish to the anode without causing physical damage.

2.5.2 Lamprey

Electro-fishing for lamprey ammocoetes was conducted using targeted box quadrat-based electro-fishing (as per Harvey & Cowx, 2003) in objectively suitable areas of sand/silt, where encountered (including three targeted areas within site E3). As lamprey take longer to emerge from silts and require a more persistent approach, they were targeted at a lower frequency (30Hz) burst DC pulse setting which also allowed detection of European eel in sediment, if present. Settings for lamprey followed those recommended and used by Harvey & Cowx (2003), APEM (2004) and Niven & McAuley (2013). Using this approach, the anode was placed under the water's surface, approx. 10–15 cm above the sediment, to prevent immobilising lamprey ammocoetes within the sediment. The anode was energised with 100V of pulsed DC for 15-20 seconds and then turned off for approximately five seconds to allow ammocoetes to emerge from their burrows. The anode was switched on and off in this way for approximately two minutes. Immobilised ammocoetes were collected by a second operator using a fine-mesh hand net as they emerged.

Lamprey species were identified to species level, where possible, with the assistance of a hand lens, through external pigmentation patterns and trunk myomere counts as described by Potter & Osborne (1975) and Gardiner (2003).

Table 2.1 *n*=5 electro-fishing survey site locations on the River Blackwater in the vicinity of Fermoy Weir, Co. Cork.

Site no.	Watercourse	EPA code	Location	X (ITM)	Y (ITM)
E1	River Blackwater	18B02	Upstream of Fermoy Weir – along weir face	581079	598606
E2	River Blackwater	18B02	Upstream of Fermoy Weir – along weir face	581118	598589
E3	River Blackwater	18B02	Downstream of Fermoy Weir – north bank channel	581189	598657
E4	River Blackwater	18B02	Downstream of Fermoy Weir – centre arch	581167	598609
E5	River Blackwater	18B02	Downstream of Fermoy Weir – downstream of weir pool	581248	598632

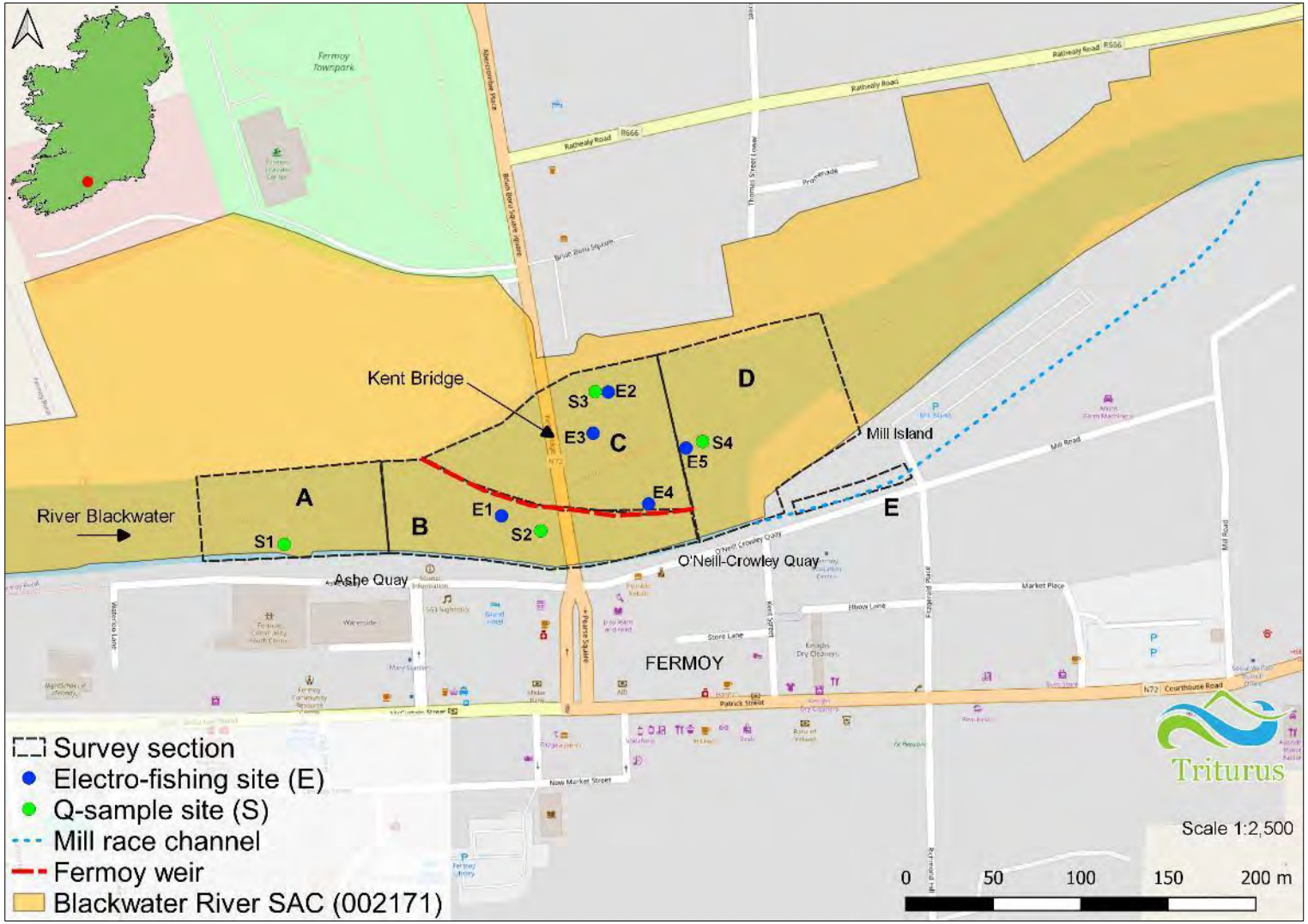

Figure 2.1 Location of aquatic survey sections in the vicinity of the proposed Fermoy Weir works, Fermoy, Co. Cork

2.6 eDNA analysis for shad species

Given limited knowledge in the known distribution and range of qualifying interest twaite shad (*Alosa fallax fallax*) within the Blackwater River SAC (002170), environmental DNA (eDNA) analysis was undertaken on water samples collected on Thursday 21st May 2020 (**Table 2.2**). Sample collection overlapped with the seasonal migration of anadromous twaite shad into Irish rivers and coincided with the known peak spawning period of the species (King & Linnane, 2004; Doherty et al., 2004). Analysis sought to elucidate the longitudinal distribution of shad species (*Alosa* spp.) within the River Blackwater, clarifying whether or not shad species could access and utilise the Fermoy Weir area. As twaite and the closely-related allis shad (*Alosa alosa*) readily hybridise, it is not feasible to use eDNA assays (which are based on mitochondrial DNA) to speciate shad. Thus, analysis could only determine the presence or absence of *Alosa* species (i.e. twaite shad and allis shad). The presence of shad species DNA in a given sample specified their presence at that location during the sampling period. A negative result indicated the species was present at undetectable densities or not present at the time of sampling.

Water samples were collected by Triturus Environmental Ltd. staff on 21st May 2020 from four areas on the River Blackwater, namely 1) upstream Fermoy Weir, 2) downstream Fermoy Weir, 3) downstream Clondulane Weir and 4) Kitchen Hole, Cappoquin (a known shad spawning site on the River Blackwater) (**Figure 2.2**). Furthermore, to act as a control, a fifth sampling site was added from the River Barrow at St. Mullin's, Co. Carlow. This site is accepted to be the most important *Alosa* spp. spawning site in Irish waters (King & Linnane, 2004; Rooney et al., 2013).

Each sample (2L sterile bottle) consisted of three biological replicates. The replicates were sampled from a cross-sectional transect at each location to account for possible intra-site fidelity demonstrated by shad species (e.g. holding in deeper areas or aggregations near spawning sites). In addition to analysis for the presence of *Alosa* spp. eDNA, samples were also analysed for the presence of brown trout (*Salmo trutta*) eDNA to ensure the genetic material in the collected water samples could be amplified successfully (i.e. positive control for all samples). Samples were kept on ice until delivery to the lab and then frozen for later analysis. All eDNA samples were analysed by BIO ID Ltd. (Dublin).

Table 2.2 Shad species (*Alosa* spp.) eDNA sampling locations on the River Blackwater and control site at St. Mullin's, River Barrow, May 2020

Replicate	Watercourse	Location	ITM (x)	ITM (y)
1A	River Blackwater	Upstream of Fermoy Weir	580934	598578
1B	River Blackwater	Upstream of Fermoy Weir	581103	598582
1C	River Blackwater	Upstream of Fermoy Weir	581139	598568
2A	River Blackwater	Downstream of Fermoy Weir	581157	598599
2B	River Blackwater	Downstream of Fermoy Weir	581232	598610
2C	River Blackwater	Downstream of Fermoy Weir	581345	598700

Replicate	Watercourse	Location	ITM (x)	ITM (y)
3A	River Blackwater	Downstream of Clondulane Weir	584983	599845
3B	River Blackwater	Downstream of Clondulane Weir	585026	599816
3C	River Blackwater	Downstream of Clondulane Weir	585079	599749
4A	River Blackwater	Kitchen Hole, Cappoquin	608567	599717
4B	River Blackwater	Kitchen Hole, Cappoquin	608799	599825
4C	River Blackwater	Kitchen Hole, Cappoquin	609818	599393
5A	River Barrow	St. Mullin's, Co. Carlow	580934	598578
5B	River Barrow	St. Mullin's	581103	598582
5C	River Barrow	St. Mullin's	581139	598568

2.7 White-clawed crayfish survey

White-clawed crayfish (*Austropotamobius pallipes*) surveys were undertaken at the aquatic survey sites in May 2020 under a National Parks and Wildlife (NPWS) open licence (no. C79/2020), as prescribed by Sections 9, 23 and 34 of the Wildlife Act (1976-2012), to capture and release crayfish to their site of capture, under condition no. 5 of the licence. As per Inland Fisheries Ireland recommendations, the crayfish licence sampling moved in a downstream direction to minimise the risk of transfer invasive propagules (including crayfish plague, *Aphanomyces astaci*) upstream.

Hand-searching of instream refugia and sweep netting was undertaken according to Reynolds et al. (2010). A broad appraisal of white-clawed crayfish habitat in each survey section (A-E) was also carried out. Furthermore, a desktop review of the known distribution of crayfish within the wider River Blackwater catchment was also completed.

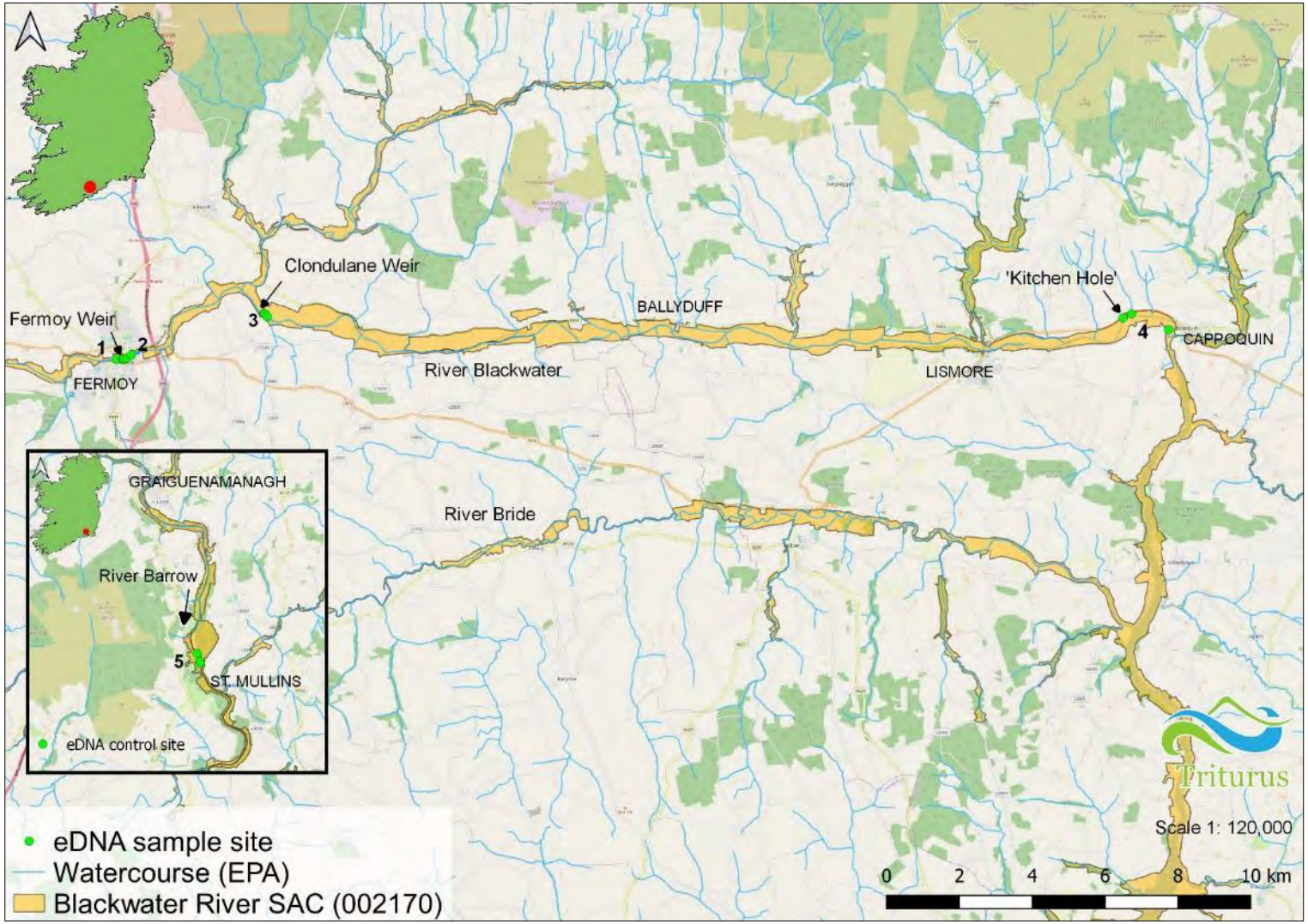

Figure 2.2 Shad species (*Alosa* spp.) eDNA sampling sites on the River Blackwater (1-4) and control site on the River Barrow (5), July 2020

2.8 Freshwater pearl mussel survey

A freshwater pearl mussel (*Margaritifera margaritifera*) survey of the River Blackwater in the vicinity of Fermoy Weir (100m upstream and 100m downstream of Kent Bridge) was completed by Pascal Sweeny of Sweeny Consultancy on Friday May 29th 2020 (**Appendix A**). Conditions were suitable, with bright, sunny weather and good water visibility under base flow conditions. This helped to maximise visibility of pearl mussel against dark substrata and also improved chances of detection when mussels were filter feeding in brighter conditions. Pearl mussel surveys were carried out under a national open licence (licence no. C15/2020), issued by the National Parks and Wildlife Service (NPWS). The survey methodology used was in accordance with the Stage 1 & 2 guidelines given in Irish Wildlife Manual No. 12, NPWS (Anon., 2004).

For a more detailed methodology please refer to **Appendix A** (freshwater pearl mussel survey).

2.9 Otter survey

An otter (*Lutra lutra*) survey was undertaken for the River Blackwater in the vicinity of the proposed works area (i.e. 250m upstream and 250m downstream of Fermoy Weir). Survey methodology followed the novel total channel otter survey (TCOS) methodology as developed by Macklin et al. (2019). Otter signs (including spraints, prints, slides and latrines) in addition to the breeding and resting places of otters (i.e. holts and couches) were searched for. This was undertaken along all bankside areas on foot and by boat, in addition to mid-channel gravel shoals and islands located downstream of Kent Bridge. Notes on the age and location (ITM coordinates) were made for each otter sign recorded, in addition to the quantity and visible constituents of spraint (i.e. remains of fish, crayfish, molluscs etc.).

2.10 Biological water quality (macro-invertebrates)

To evaluate biological water quality within the survey area, Q-sampling was carried out at *n*=4 sites in the vicinity of Fermoy Weir (S1-S4; **Figure 2.1**). Macro-invertebrate samples were converted to Q-ratings as per Toner et al. (2005). All samples were taken with a standard kick sampling hand net (250mm width, 500µm mesh size) from areas of riffle/glide utilising a two-minute sample, as per ISO standards for water quality sampling (ISO 10870:2012). Large cobble was also washed at each site, where present, and samples were elutriated and fixed in 70% ethanol for subsequent laboratory identification. Any rare invertebrate species were identified from the NPWS Red List publications for beetles (Foster et al., 2009), stoneflies (Feeley et al., 2020), mayflies (Kelly-Quinn & Regan, 2012) and other relevant taxa (i.e. Byrne et al., 2009; Nelson et al., 2011).

Table 2.3 Reference Categories for EPA Q-Ratings (Q1 to Q5)

Q Value	WFD Status	Pollution Status	Condition
Q5 or Q4-5	High Status	Unpolluted	Satisfactory
Q4	Good Status	Unpolluted	Satisfactory
Q3-4	Moderate Status	Slightly polluted	Unsatisfactory
Q3 or Q2-3	Poor	Moderately polluted	Unsatisfactory
Q2, Q1-2 or Q1	Bad	Seriously polluted	Unsatisfactory

2.11 Aquatic ecological evaluation

The evaluation of ecological receptors contained within this report uses the geographic scale and criteria defined in the Guidelines for Assessment of Ecological Impacts of National Road Schemes (NRA, 2009).

2.12 Biosecurity

A strict biosecurity protocol following the Check-Clean-Dry approach was employed during the survey. Equipment and PPE used was disinfected with Virkon® between survey sites to prevent the transfer of pathogens and/or invasive species between survey areas. Particular cognisance was given to the risk of spreading or introducing crayfish plague (*Aphanomyces astaci*), given the presence of white-clawed crayfish within the River Blackwater (including within the survey area). Equipment was disinfected and thoroughly dried (through UV exposure) prior to survey commencement. As per best practice, surveys were undertaken at sites in a downstream order (i.e. uppermost site surveyed first etc.) to prevent the upstream mobilisation of invasive propagules and pathogens. Any invasive species recorded within or adjoining the survey area were geo-referenced.

3. Results

The following section summarises each aquatic survey site in terms of aquatic habitats, physical characteristics and overall value for fish, macrophyte communities and macro-invertebrates. Biological water quality results are also summarised. Habitat codes are according to Fossitt (2000). Scientific names are provided at first mention only. An evaluation of the aquatic ecological importance of the survey areas based on the aquatic surveys is provided in **section 3.10**

3.1 Desktop review

A sensitive species data request for terrestrial and aquatic flora and fauna covering the 10km grid squares adjoining the proposed works area (i.e. W79 & W89) revealed records for a number of protected (freshwater) aquatic species in the vicinity of the proposed works area, as did data from the National Biodiversity Data Centre (NBDC).

Otter (*Lutra lutra*) records were widespread throughout the respective grid squares, on the River Blackwater and several tributaries (NBCD & NPWS data). Although no records overlapped the survey area, otter were known locally in the vicinity of Fermoy Weir (pers. obs.) see **section 3.8** below for otter survey results.

Numerous records for freshwater pearl mussel (*Margaritifera margaritifera*) were available for the respective grid squares, confined to the River Blackwater main channel. Whilst most records were for the river in the vicinity of Ballyhooly (upstream of Fermoy), two historical records were available for the Blackwater upstream (1917) and downstream (1987) of Fermoy town, respectively (NPWS data). Four live mussels were recorded at Fermoy Weir in 2011 but these are no longer present (see **Appendix A**).

A low number of records for white-clawed crayfish (*Austropotamobius pallipes*) were available for the River Blackwater near Ballyhooly (W79) but none overlapped with the survey area (NBDC & NPWS data). However, records compiled during the current study are presented in **section 3.6** below.

Numerous sea lamprey (*Petromyzon marinus*) records were available for the River Blackwater in the downstream vicinity of Fermoy Weir (c.50-400m downstream of weir during 2003; NPWS data). Numerous records were also available for the area downstream of Clondulane Weir (Careysville) also from 2003. Upstream of Fermoy, a known sea lamprey spawning site was present at Ballyhooly Bridge, with an additional record available for Castlehyde area in the vicinity of Fermoy town (2003 records; NBDC data). Whilst river lamprey (*Lampetra fluviatilis*) were known from the River Blackwater, only a single historical record which overlapped the survey area was available (approx. 50m downstream Fermoy Weir, no date provided; NPWS data).

Although no shad species records were available for the Fermoy area, two allis shad (*Alosa alosa*) records were available for the area c.1km downstream of Clondulane Weir (from 2003 & 2005; NPWS data; King & Linnane, 2004). Both twaite and allis shad are known from the lower reaches of the River Blackwater.

3.2 Summary of results by survey section

3.2.1 Section A – >100-200m upstream Fermoy Weir

Section A was located >100-200m upstream of the existing Fermoy Weir structure (**Figure 2.1; Plate 3.1**). This section was dominated by homogenous deep glide habitat, with the River Blackwater (lowland depositing watercourse, FW2)) averaging 40-50m wide and 2-3m in depth. The river flowed through a deep U-shaped channel, with steep marginal sloping areas. The river channel was highly modified along the south bank, being bound by built land (BL3) and retaining walls approx. 2m above the surface of the river at the time of survey (note: extremely low water levels at the time of survey, May-June 2020). The substrata were dominated by boulder and cobble (60% overall), with patches of coarse gravels. Some sand and silt accumulations were present along the littoral zone of steep river margins. Generally, the substrata were relatively highly bedded with moderate siltation. Instream macrophytes were limited given the mean depth, with sparse marginal growth of spiked water milfoil (*Myriophyllum spicatum*) and hemlock water dropwort (*Oenanthe aquatica*). Instream bryophytes were limited to occasional *Fontinalis antipyretica* on larger boulders. Filamentous algal cover was particularly high at the time of survey, especially in marginal slope areas. Given the paucity of macrophytes upstream of the weir, no good examples of the Annex I habitat 'Water courses of plain to montane levels, with submerged or floating vegetation of *Ranunculion fluitantis* and *Callitricho-Batrachion* or aquatic mosses [3260]' was recorded. No vegetation representative of 'Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels [6430]' was recorded.

The north bank featured a scattered mature riparian treeline comprised of sycamore (*Acer psuedoplatanus),* elder (*Sambucus nigra*), ash (*Fraxinus excelsior*), aspen (*Populus tremula*), hawthorn (*Crataegus monogyna*), hazel (*Corylus avellana*) and occasional alder (*Alnus glutinosa*) and wych elm (*Ulmus glabra*). The scrubby understorey was dominated by bramble (*Rubus fruticosus* agg.) and nettle (*Urtica dioica*). Reed canary grass (*Phalaris arundinacea*) was common along channel margins, more so on the north bank. The river was bordered by improved agricultural grassland (GA1) to the north.

Section A was too deep to electro-fishing utilising backpack equipment (mostly >2m) and, therefore, no results were available. However, in terms of fisheries habitat, the deep glide habitat of section A offered good salmonid holding habitat, with nursery and spawning habitat much improved downstream of the weir. The river upstream of the weir offered very good European eel (*Anguilla anguilla*) habitat given the presence of deep water and frequent boulder/cobble refugia. Observably, the section also supported a large population of non-native dace (*Leuciscus leuciscus*), non-native roach (*Rutilus rutilus*) and other species such as minnow (*Phoxinus phoxinus*). Lamprey habitat was poor given the high average depth, slower flow and bedded substrata, resulting in a general lack of suitable sediment accumulations for ammocoetes and poor spawning habitat. White clawed crayfish habitat was of moderate quality with suitability mainly in the channel margins under boulder and large woody debris. However, only very low densities were recorded (see **section 3.5**). Freshwater pearl mussel habitat was poor given bedded substrata, seasonally low flows and evident siltation/enrichment. None were recorded present (**Appendix A**).

A biological water quality rating of **Q3-4**, corresponding to WFD **moderate status,** was assigned for this survey section (i.e. site S1, **section 3.9** & **Table 3.1**). No rare or protected macro-invertebrate species were recorded in the sample.

Plate 3.1 Representative image of section A >100m upstream of Fermoy Weir, July 2020 (facing downstream towards bridge).

3.2.2 Section B – 0-100m upstream of Fermoy Weir

As per section A, Section B (located <100m upstream of the existing weir face) was dominated by homogenous deep glide habitat, with the River Blackwater averaging 40-50m wide and 2-2.5m in depth (**Plate 3.2, Figure 3.3**). The existing Fermoy Weir structure bisected the section immediately upstream of Kent Bridge. The structure was approx. 150m in length and ran from a NW to SE direction. Significant structural damage was evident along the weir face. The river in section B flowed through a deep U-shaped channel, with steep marginal sloping areas. The channel was highly modified along the south bank, being bound by built land (BL3) and retaining walls approx. 2m above the surface of the river at the time of survey (note: very low water levels at the time of survey, May-June 2020). The substrata were dominated by boulder and cobble (70% overall), with frequent patches of coarse gravels. Some sand and silt accumulations were present along the littoral zone of steep river margins. Generally, the substrata were bedded with moderate siltation. Instream macrophytes were limited given the deeper water and predominance of hard substrata, with sparse marginal growth of spiked water milfoil and yellow water lily (*Nuphar lutea*) and occasional small stands of hemlock water dropwort on exposed gravel shoals (often inundated at higher water levels). The weir structure supported sparse growth of hemlock water dropwort in addition to the aquatic mosses *Cinclidotus fontinaloides* and *Fontinalis antipyretica* on the wetted faces. Filamentous algal cover was particularly high at the time of survey, especially in marginal slope areas. Given the paucity of macrophytes upstream of the weir, no good examples of the Annex I habitat 'Water courses of plain to montane levels, with submerged or floating vegetation

of *Ranunculion fluitantis* and *Callitricho-Batrachion* or aquatic mosses [3260]' was recorded. No vegetation representative of 'Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels [6430]' was recorded.

The north bank featured a scattered mature riparian treeline comprised of sycamore, elder, ash, aspen, hawthorn, hazel and occasional alder and wych elm. The scrubby understorey was dominated by bramble and nettle. The river was bordered by improved agricultural grassland (GA1) to the north.

Electro-fishing was undertaken at one site within (E1) within survey section B (**Figure 2.1**). A total of *n*=4 fish species were recorded (section 3.3). Atlantic salmon (*Salmo salar*) and brown trout (*Salmo trutta*) dominated, with low numbers of European eel and dace captured (see section 3.3).

White clawed crayfish habitat was of moderate quality, particularly in the vicinity of the weir structure where low densities were recorded (section 3.6). Freshwater pearl mussel habitat was poor given bedded substrata, seasonally low flows and evident siltation/enrichment. None were recorded present (see **Appendix A**).

A biological water quality rating of **Q3-4**, corresponding to WFD **moderate status**, was assigned for this survey section (i.e. S2, **section 3.9** & **Table 3.1**). No rare or protected macro-invertebrate species were recorded in the sample.

Plate 3.2 Representative image of section B (0-100m upstream of Fermoy Weir), June 2020 showing old fish pass, facing downstream towards bridge.

3.2.3 Section C – 0-100m downstream Fermoy Weir

Section C, located downstream of the existing weir structure, featured faster and more heterogeneous flows than upstream. Structural damage to the weir in recent years had resulted in accelerated deep (>1.5m) fast glide habitat along the south bank (main flow), feeding a large, deep pool approx. 30m downstream of Kent Bridge, along O'Neill-Crowley Quay (section D, **Plate 3.3).** The river along the south bank was considerably shallower (<1m, often <0.5m) and dominated by riffle and shallow glide habitat, with pool-like/eddy habitat pool located in the vicinity of the bridge (i.e. between weir face and islands). Overall, the substrata were dominated by well-mixed gravels and small cobble in most areas. Fine sediment (silt and clay) accumulations were associated with instream macrophyte beds and had caused some local bedding of substrata. However, overall, the substrata were generally mobile and free from sedimentation. At low water levels, numerous small islands of exposed gravel and cobble were present immediately downstream of the bridge. The lee of these islands supported fine sediment accumulations ranging from 1-10cm in depth and offered good lamprey potential (see **section 3.3**).

The river channel was bordered to the north by a mature treeline comprising alder, ash and sycamore with elder, willow and hawthorn adjoining improved agricultural grassland (pasture). The south (town) bank along O'Neill-Crowley Quay was bound by retaining walls. The north bank of the river immediately downstream of the bridge featured muddy paludal areas supporting localised great yellow-cress (*Rorippa amphibia*), hemlock water dropwort (*Oenanthe crocata*), pink water speedwell (*Veronica catenata*) and water-forget-me-not (*Myosotis scorpioides*). These littoral species graded into more extensive swards of reed canary grass on drier ground (including islands). Muddy areas below the water line supported occasional stands of flowering rush (*Butomus umbellatus*) (one large 10m^2 stand) and infrequent branched bur-reed (*Sparganium erectum*). The upper drier gravel areas of instream islands supported great willowherb (*Epilobium hirsutum*), marsh willowherb (*Epilobium palustre*), ribwort plantain (*Plantago lanceolata*), common figwort (*Scrophularia nodosa*), charlock (*Sinapis arvensis*), vetch (*Vicia* sp.), creeping yellowcress (*Rorippa sylvestris*), bittercress (*Cardamine* sp.) and marsh woundwort (*Stachys palustris*). Exposed gravel and cobble littorals of such instream islands also supported frequent redshank (*Persicaria maculosa*), water pepper (*Persicaria hydropiper*) and fat hen (*Chenopodium album*) with less frequent patches of hemlock water dropwort. Curled dock (*Rumex crispus*) and creeping yellowcress were more localised. The muddy margins of these islands supported water plantain (*Alisma plantago-aquatica*) and water mint (*Mentha aquatica*). Himalayan balsam (*Impatiens glandulifera*) was occasional. Given the presence of ≥3 indicator species (see Devaney et al., 2013), the Annex I habitat 'Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels [6430]' was also recorded in association with mid-channel islands and along the north bank of the river (downstream of Kent Bridge).

In contrast to upstream, macrophyte cover was high with growth dominated by water crowfoot (*Ranunculus* subspecies *Batrachion* agg.) vegetation, which formed large stands along the shallow fast glide of the north bank, downstream of the bridge (30% cover overall). Spiked water milfoil was also locally frequent with occasional *Callitriche* sp. between islands/gravel shoals and along muddy river margins. Small, localised stands of unbranched bur-reed (*Sparganium emersum*) were also present. *Fontinalis antipyretica* was recorded very locally on large cobble. The moss

species *Cinclidotus fontinaloides* was very abundant along the dry weir faces. Given the presence of ≥3 indicator species (see EC, 2013), the macrophyte community recorded was considered representative of the Annex I habitat 'Water courses of plain to montane levels, with submerged or floating vegetation of *Ranunculion fluitantis* and *Callitricho-Batrachion* or aquatic mosses [3260]'.

Electro-fishing was undertaken at three sites (E2, E3 and E4) within survey section C (**Figure 2.1**). A total of *n*=10 fish species were recorded across the three sites (i.e. Atlantic salmon, brown trout, minnow, roach, dace, European eel, three-spined stickleback (*Gasterosteus aculeatus*), gudgeon (*Gobio gobio*), stone loach (*Barbatula barbatula*) and *Lampetra* sp. (see section 3.3). Three discrete 2m^2 areas (i.e. A, B & C) in the vicinity of mid-channel islands were targeted for lamprey ammocoetes (i.e. site E5, **Figure 2.1**). All of these areas supported *Lampetra* sp. ammocoetes, with equivalent densities of 10.5, 12 and 15 ammocoetes per m^2 recorded, respectively (section 3.3).

Section C offered some excellent salmonid nursery habitat, with some locally excellent spawning substrata and holding habitat present also. European eel habitat was good overall. White-clawed crayfish habitat was good in the vicinity of Kent Bridge (particularly the northern half of the river) with moderate densities of juvenile and adult crayfish were recorded via sweep netting and snorkelling during the site visit (see **section 3.6**). Despite some improved suitability compared to upstream areas, no freshwater pearl mussel were recorded present in section C. Pearl mussel habitat was sub-optimal given seasonally low flows and evident siltation/enrichment (**Appendix A**).

A biological water quality rating of **Q4**, corresponding to WFD **good status**, was assigned for this site (i.e. site S3, **section 3.9** & **Table 3.1**). No rare or protected macro-invertebrate species were recorded in the sample.

Plate 3.3 Representative image of the downstream extent of section C (0-100m downstream of Fermoy Weir), June 2020.

Plate 3.4 Representative image of section C (0-100m downstream of Fermoy Weir), July 2020 showing existing wall (right) and mid-channel islands (left).

Plate 3.5 Representative image of section C (0-100m downstream of Fermoy Weir), July 2020 facing upstream towards Kent Bridge from the O'Neill Crowley Quay retaining wall (large weir pool located in the right foreground was located within section D).

3.2.4 Section D - >100-200m downstream Fermoy Weir

Section D, located ≥100m downstream of the existing weir structure, was dominated by very fast glide and pool habitat, invariably <1m in depth. Deeper glide and pool was present >200m downstream (i.e. towards the downstream extent of Mill Island). The large pool associated with the existing weir, along O'Neill-Crowley Quay (**Plate 3.3**), ranged from 2-2.5m in depth at the time of survey (i.e. low water levels). Standing water/ponding (<0.3m max. depth) was present on and to the south of the large exposed gravel island (usually mostly inundated at normal water levels). In the river channel the substrata were dominated by cobble and coarse gravel. Large cobble and limited large boulders were present in the weir pool. Given high flow rates, the substrata were generally mobile and free from sedimentation although some shallow silt/sand accumulations were present in marginal slacks and in association with macrophyte beds.

The river channel was bordered to the north and south by a mature treeline comprising alder, ash and sycamore with elder, willow and hawthorn. Reed canary grass formed large stands on island centers with inundation zones colonised by annuals of exposed gravel. The upper drier gravel areas of instream islands supported great willowherb, marsh willowherb, ribwort plantain, common figwort, charlock, vetch (*Vicia* sp.), creeping yellowcress, bittercress (*Cardamine* sp.) and marsh woundwort. Exposed gravel and cobble littorals of such instream islands also supported frequent redshank, water pepper and fat hen with less frequent patches of hemlock water dropwort. Curled dock and creeping yellowcress were more localised. The muddy margins of these islands supported water plantain and water mint. Himalayan balsam was occasional. Given the presence of ≥3 indicator species (see Devaney et al., 2013), the river islands supported good examples of the Annex I habitat 'Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels [6430]'.

In terms of macrophytes, *Ranunculus* subspecies *Batrachion* agg. vegetation was present but was localised in the main channel downstream of the pool and island (10% cover). Some limited spiked water milfoil and *Callitriche* sp. was present at the section C-D interface. *Fontinalis antipyretica* was recorded very locally on larger cobble and boulder. Given the presence of ≥3 indicator species (EC, 2013), the macrophyte community recorded was considered representative of the Annex I habitat 'Water courses of plain to montane levels, with submerged or floating vegetation of *Ranunculion fluitantis* and *Callitricho-Batrachion* or aquatic mosses [3260]'.

Electro-fishing was undertaken at one (E5) within survey section D (**Figure 2.1**). A total of *n*=3 fish species were recorded, with low numbers of dace, stone loach and three-spined stickleback present (see **section 3.3**). Section D offered excellent salmonid habitat overall, with high-quality spawning, nursery and holding habitat present. Lamprey spawning habitat was also present (including for sea lamprey) with some good European eel habitat associated with deeper pool areas. Good-quality white-clawed crayfish habitat was limited to the vicinity of the weir face and associated deep pool. Low numbers were recorded via sweep netting along the weir face adjoining this pool (see **section 3.6**). Despite some improved suitability compared to upstream areas, no freshwater pearl mussel were recorded present in section D. Pearl mussel habitat was sub-optimal given seasonally low flows and evident siltation/enrichment (**Appendix A**).

A biological water quality rating of **Q3-4**, corresponding to WFD **moderate status**, was assigned for this survey section (i.e. S4, **section 3.9** & **Table 3.1**). No rare or protected macro-invertebrate species were recorded in the sample.

Plate 3.6 Representative image of section D (>100-200m downstream of Fermoy Weir), June 2020, facing downstream from the largest mid-channel island near Kent Bridge.

Plate 3.7 Representative image of section D, July 2020, facing upstream towards Kent Bridge.

3.2.5 Section E – Mill-race channel

Site E represented the uppermost 100m of a disused mill race channel, that averaged 7-8m and 0.3-0.5m in depth at the time of survey. The channel was not located within the Blackwater River SAC site (**Figure 2.1**). Held between 2-3m-high retaining walls, the channel diverged from the River Blackwater through a flood wall (formerly sluice gates) near the weir pool along O'Neill-Crowley Quay/Mill Road. The channel rejoined the main river approx. 400m downstream. The channel supported standing water only at the time of survey (100% pool habitat), although it was known to convey significantly higher water volumes, seasonally. The channel substrata were dominated by deep silt, often >0.5m in depth. Otter prints (recently made) were recorded in the muddy paludal under the road bridge to the Mill Island car park (ITM 581346,598612).

The site was heavily-vegetated and supported a diverse macrophyte and riparian plant community. Instream, unbranched bur-reed was abundant, with frequent Canadian pondweed (*Elodea canadensis*), broad-leaved pondweed (*Potamogeton natans*) and common duckweed (*Lemna minor*). *Callitriche* sp. and water plantain were occasional. Given the presence of only two indicator species (*Potamogeton* sp. and *Callitriche* sp.; EC, 2013), the macrophyte community did not correspond to the Annex I habitat 'Water courses of plain to montane levels, with submerged or floating vegetation of *Ranunculion fluitantis* and *Callitricho-Batrachion* or aquatic mosses [3260]'.

The margins of the channel, exposed to occasional inundation, supported abundant reed canary grass with flowering rush, fool's watercress (*Apium nodiflorum*), water mint, blue water speedwell (*Veronica anagallis-aquatica*), bittersweet (*Solanum dulcamara*) and redshank. Given the good species diversity, the plant community of the upper reaches of the mill-race channel was considered representative of the Annex I habitat 'Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels [6430]'.

Electro-fishing was not undertaken in section E. Due to poor connectivity with the main river, the survey reaches of the channel were of little fisheries value apart from for European eel. However, fisheries value improved considerably in the downstream reaches, where some good value as a coarse fish nursery was present.

Biological water quality was not assessed in survey section E due to Q-sampling unsuitability (i.e. non-flowing canal habitat) and no macro-invertebrate sweep sample was taken.

Plate 3.8 Representative image of site E, the heavily vegetated mill-race channel downstream of the proposed works area, July 2020.

Plate 3.9 Representative image of marginal vegetation including flowering rush representative of the Annex I habitat 'Hydrophilous tall herb [6430]', July 2020.

Figure 3.1 Drone ortho-mosaic image of the Fermoy Weir survey area, June 2020

3.3 SONAR survey

As anticipated, the boat-based SONAR survey revealed a clear differential in the bathymetric profile upstream and downstream of the weir (**Figure 3.2**). Upstream of the existing weir (i.e. survey section A and most of section B) featured deeper glide habitat averaging 1.5-2.5m, while downstream the average depth of the areas dominated by faster-flowing glide habitat averaged 0.5-<1.5m. Although some locally deeper pool areas were present, the majority of survey sections C and D (downstream of the weir) were ≤1m in depth.

The plots of river hardness (**Figure 3.3**) and river bed rugosity (**Figure 3.4**) illustrated the dominance of softer substrata in the shallower areas, such as those in the vicinity of mid-channel islands downstream of Kent Bridge. These areas are indicated by higher relative scores in both the river hardness and rugosity maps (**Figures 3.3 & 3.4**). In this respect silt dominated areas are softer and smoother as reflected in the scores and concentrated in the northern half of the River Blackwater channel downstream of the weir. The deeper glide and pool areas (e.g. sections A and D) supported harder substrata with higher rugosities (greater substrata complexity/ roughness) with very localised lamprey ammocoete habitat (as illustrated by the dark red banding on **Figures 3.3 & 3.4**).

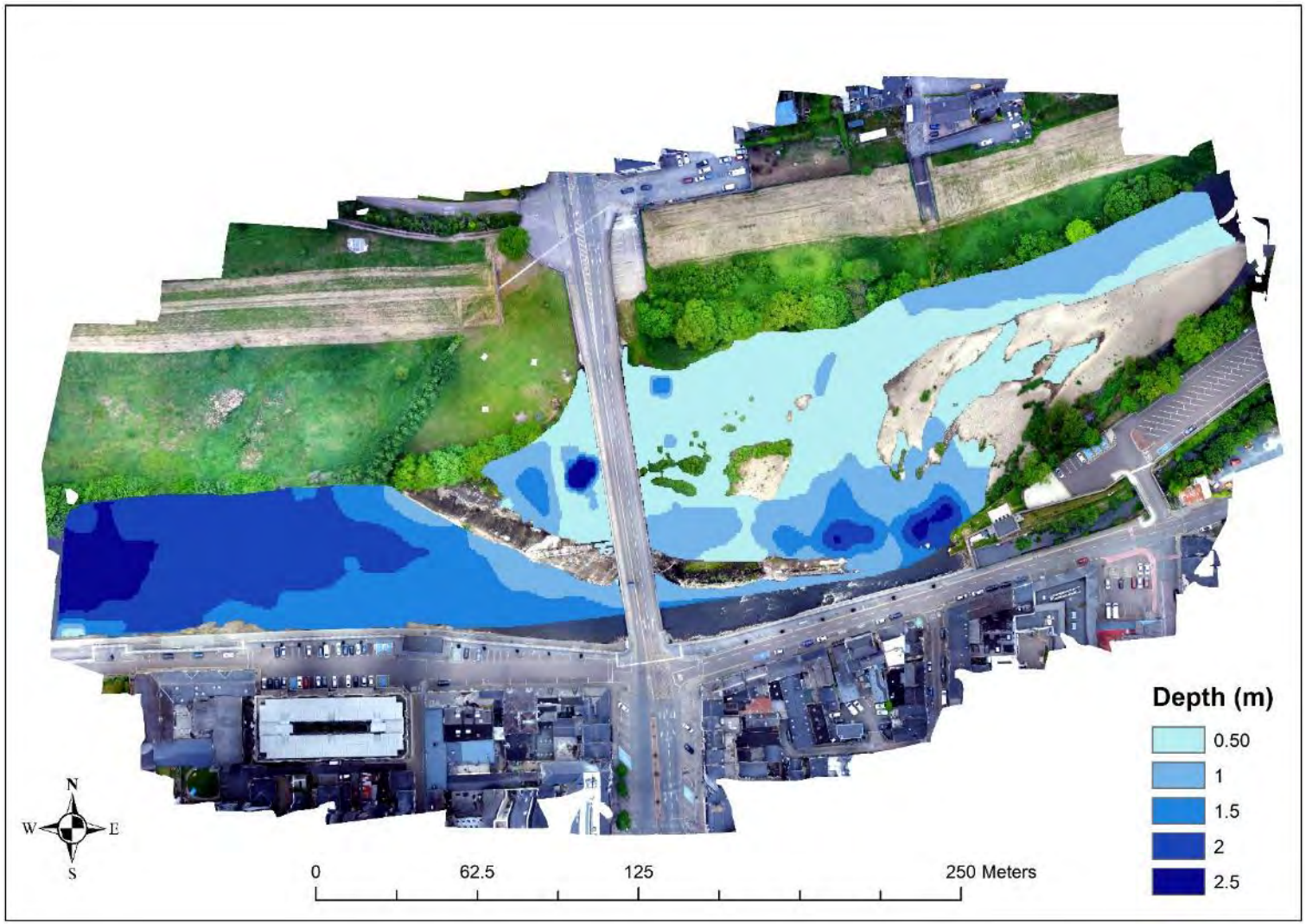

Figure 3.2 Bathymetry map of the survey area, July 2020 (darker shading indicates deeper water)

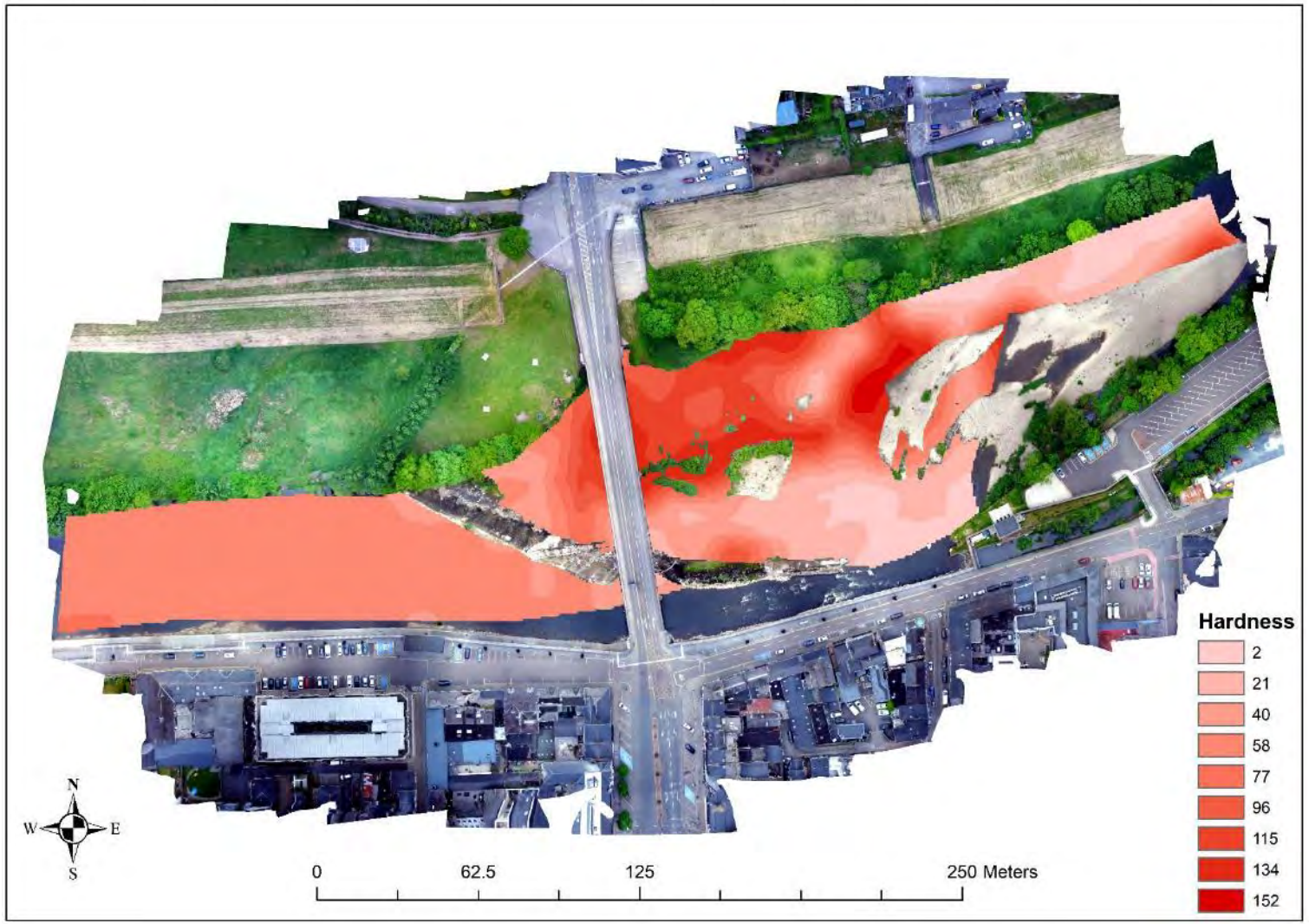

Figure 3.3 Relative river bed hardness map of the survey area, July 2020 (darker shading indicates softer substrata)

Figure 3.4 Relative river bed rugosity (roughness) map of the survey area, July 2020 (darker shading indicates areas of smoother substrate complexity)

3.4 Fisheries assessment (electro-fishing survey)

3.4.1 Site E1

A total of four fish species were recorded from site E1 (**Figure 3.5**), located along the existing weir face upstream of Kent Bridge. Atlantic salmon and brown trout parr dominated, with a low number of European eel also recorded. A single juvenile dace was captured although large shoals of juveniles and adults were observed during electro-fishing in the adjoining deep glide habitat (i.e. survey section B).

The area of river along the existing weir face (upstream of the bridge) was evidently of good value as a salmonid nursery. The abundant large cobble and boulder habitat provided valuable refugia from the main flow of the channel for both Atlantic salmon and brown trout. Similarly, the boulder-dominated areas and scoured weir face also provided some very good European eel refugia. The section along the weir face was not of value as a salmonid spawning habitat but did provide some localised holding habitat for migrating adults. The area was not of value for lamprey (no sediment accumulations or suitable spawning substrata).

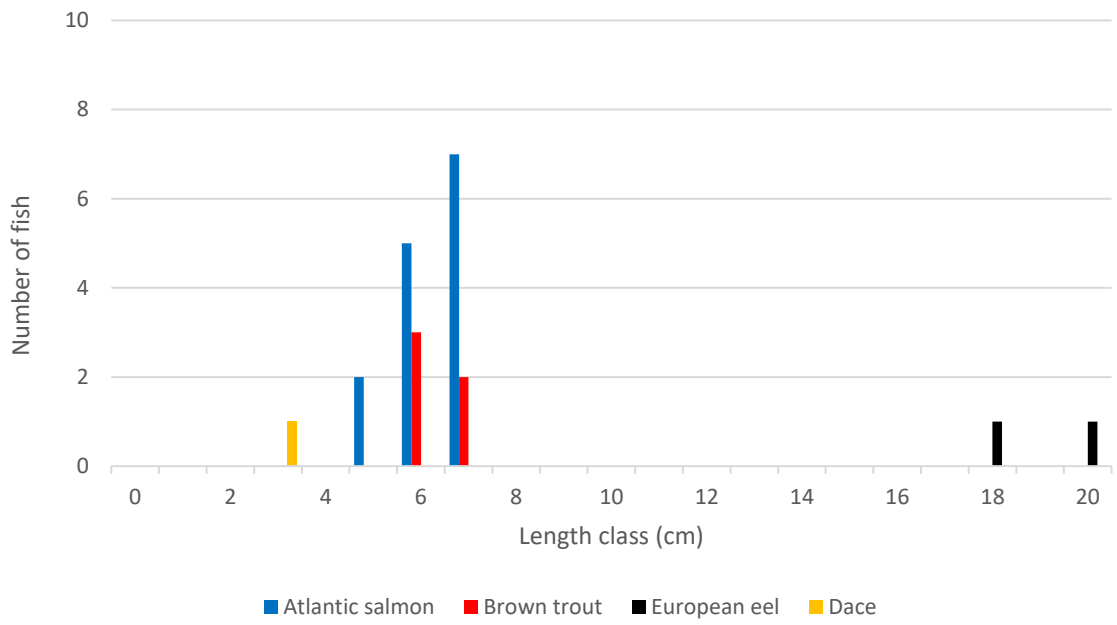

Figure 3.5 Fish length frequency distribution recorded via electro-fishing from site E1 on the River Blackwater, Fermoy Weir, July 2020

3.4.2 Site E2

A total of eight fish species were recorded from site E2 (**Figure 3.6**), located along the north bank of the river downstream of Kent Bridge. Atlantic salmon parr (*n*=10) and minnow (*n*=12) were the most frequently recorded species. A single adult brown trout (FL 24.2cm) and juvenile roach was recorded in addition to low numbers of European eel, gudgeon and stone loach. A single *Lampetra* sp. ammocoete was also captured.

The north channel of the river downstream of Kent Bridge was a very good salmonid nursery habitat, supporting moderate densities of Atlantic salmon parr and low numbers of brown trout. The fast, shallow glide presented good salmonid spawning habitat (mobile, clean gravels/cobbles) whilst instream macrophytes (water crowfoot, spiked water-milfoil etc.) provided valuable refugia for juveniles. Holding habitat was largely absent in this area although was abundant downstream and adjoining the existing weir structure (south bank of river). *Lampetra* sp. spawning habitat was good overall, particularly adjoining mid-channel islands where finer gravel substrata were frequent. Although a single ammocoete was recorded, burial habitat was restricted to very small patches of shallow, soft sediment associated with instream macrophyte beds. However, excellent ammocoete habitat was present adjoining the mid-channel islands adjacent to the site (see section 3.4.3 below). European eel habitat was good in vicinity of the bridge structure, where frequent boulder and large cobble provided suitable diurnal refugia (**Plate 7.2**).

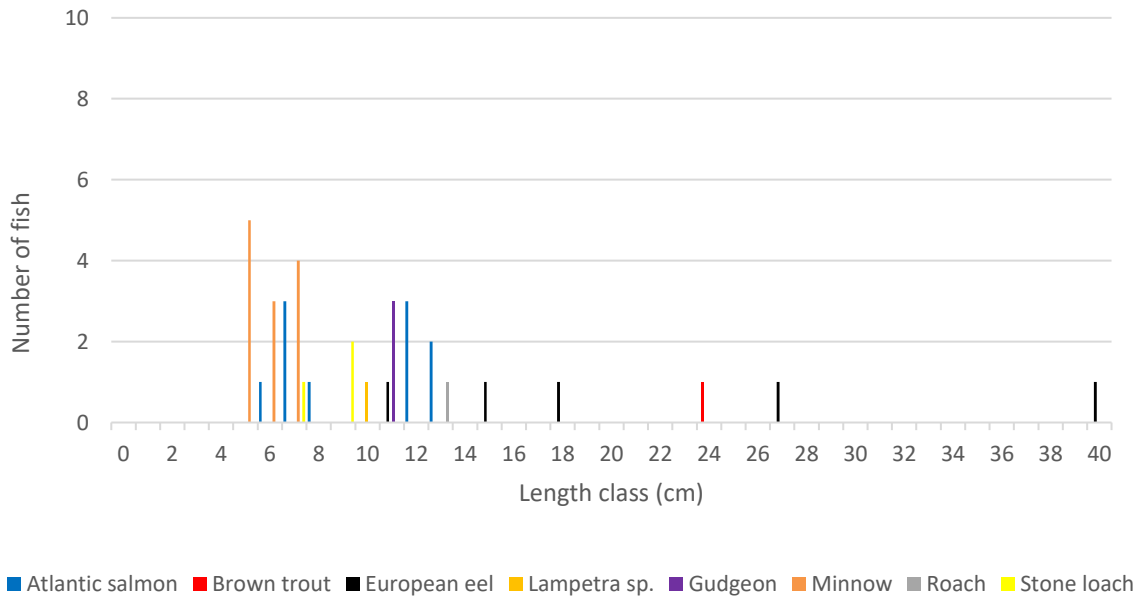

Figure 3.6 Fish length frequency distribution recorded via electro-fishing from site E2 on the River Blackwater, Fermoy Weir, July 2020.

3.4.3 Site E3

Three discrete 2m^2 areas (i.e. A, B & C) in the vicinity of mid-channel islands within survey section C were targeted for lamprey ammocoetes (**Figure 2.1**). All of these areas supported *Lampetra* sp. ammocoetes, with equivalent densities of 10.5, 12 and 15 ammocoetes per m^2 recorded, respectively (**Figure 3.7, 3.8**). A range of size/age classes were present with ammocoetes ranging from 3.3-11.1cm total length (e.g. **Plate 7.4**). A low number of European eel elvers were also recorded from the sediment in area A (data not shown; 8.9-14.3cm TL; **Plate 7.5**).

Evidently, all three targeted areas were of high value to larval lamprey. These were located in areas adjoining shallow glide habitat (0.15-0.4m deep) and featured fine, organic-rich soft sediment accumulations of ≥5cm in depth. All three areas also adjoined fine gravel substrata suitable for *Lampetra* sp. spawning.

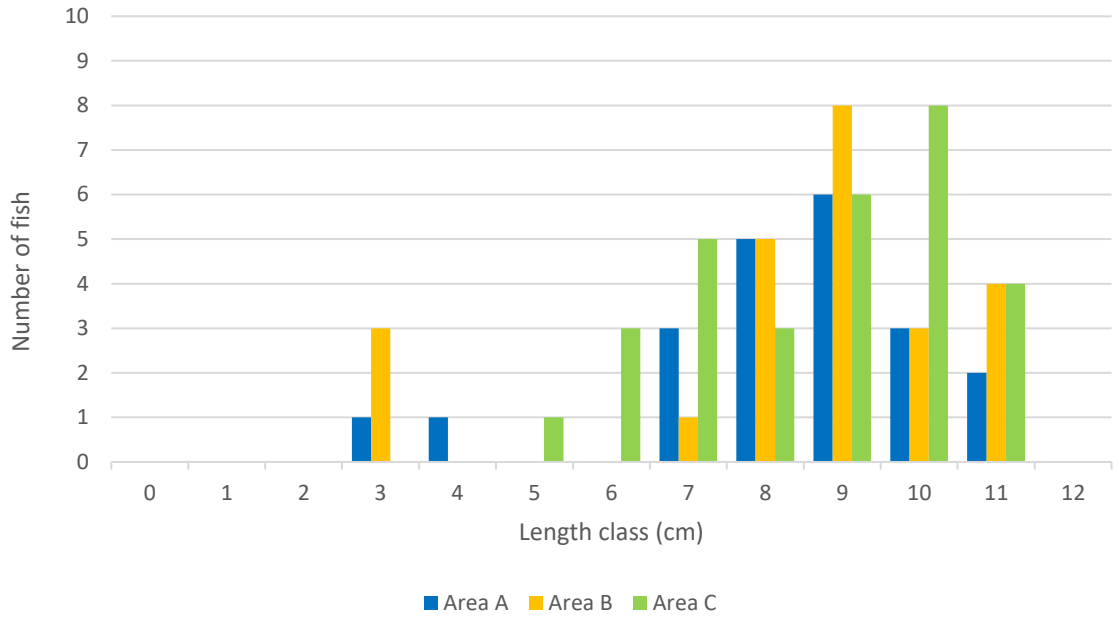

Figure 3.7 *Lampetra* sp. ammocoete length distribution recorded via electro-fishing in areas A, B and C of site E3 on the River Blackwater, July 2020

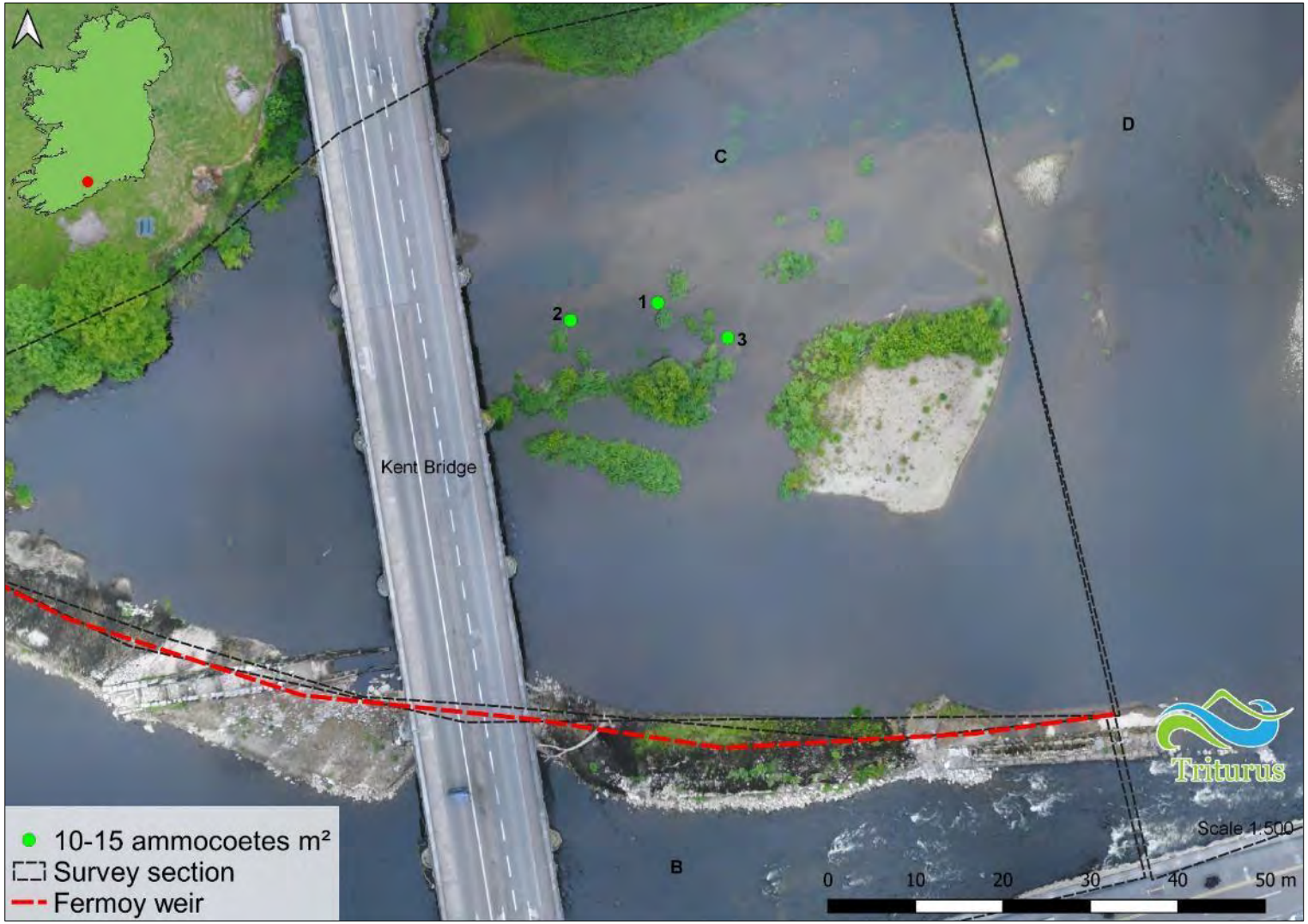

Figure 3.8 Density of *Lampetra* sp. ammocoetes recorded from the three 2m^2 targeted areas within site E3, July 2020

3.4.4 Site E4

A total of five fish species were recorded from site E4 (**Figure 3.9**), located along the existing weir face downstream of Kent Bridge. Low numbers of Atlantic salmon parr, stone loach, juvenile dace and minnow were recorded, in addition to two juvenile European eel.

Site E4 was dominated by slow-flowing glide/pool at the time of survey (basal summer flows). As a result, the area supported only low densities of fish. Salmonid habitat was moderate overall, with the area of most value as a salmonid nursery and (particularly at higher water levels), holding habitat for adults. However, salmonid habitat was significantly improved in adjoining downstream areas (i.e. weir pool and main channel of the river). European eel habitat was good overall given the frequency of boulder refugia as well as scouring of the existing weir face which also offered diurnal refugia. The area was of little value as a lamprey spawning or nursery habitat given the typically low flows (mostly pool habitat). The area was of high value as a coarse fish nursery (e.g. dace, roach etc.).

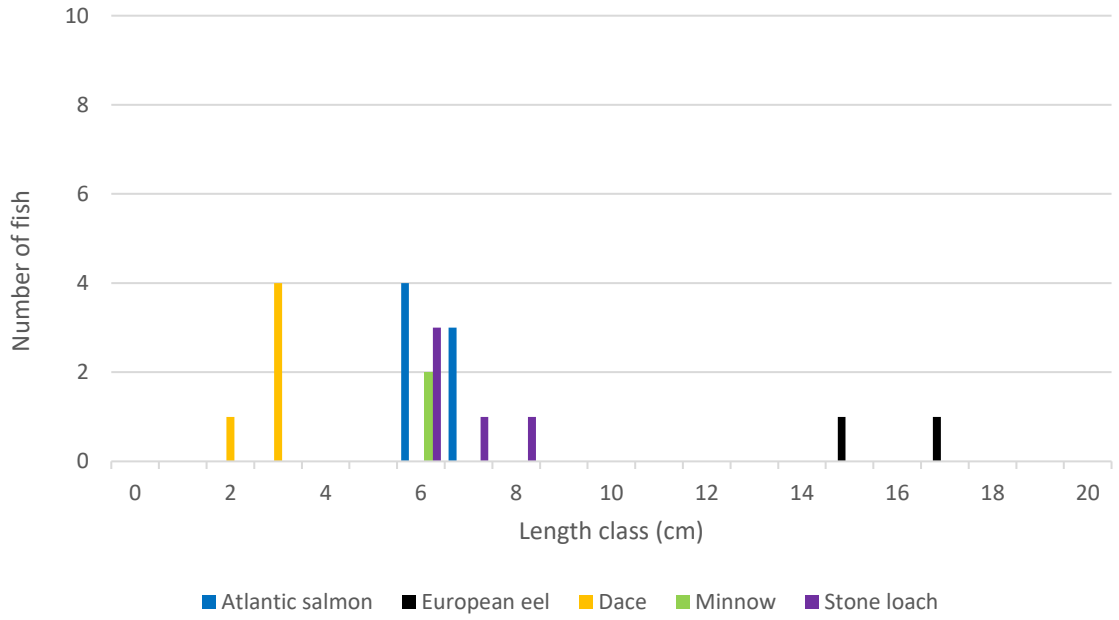

Figure 3.9 Fish length frequency distribution recorded via electro-fishing from site E4 on the River Blackwater, Fermoy Weir, July 2020

3.4.5 Site E5

A total of three fish species were recorded from site E5 (**Figure 3.10**), located downstream of the largest island, downstream of Kent Bridge. Dace were the most frequently recorded species in this area (juveniles and adults), with low numbers of stone loach and three-spined stickleback also recorded.

Site E5 represented fast glide habitat adjoining the main flow of the river (deeper and faster glide/pool where electro-fishing was not possible). Although the area presented some excellent quality salmonid spawning habitat (clean and mobile gravel/cobble), as well as good nursery habitat downstream, no salmonids were recorded (these were likely present in adjoining deeper pool and glide areas). Dace were frequent in the shallower areas of fast glide adjacent to the main flow, with low numbers of stickleback and stone loach present in association with instream macrophytes located at the downstream extent of the section. The site was unsuitable for larval lamprey although some good spawning was present locally (no sediment accumulations present although some downstream near macrophyte beds). However, this area was more suited to larger lamprey species (e.g. sea and river lamprey) and Atlantic salmon. European eel habitat was poor in the shallow, fast glide but was considered very good in adjacent pool/deep glide areas.

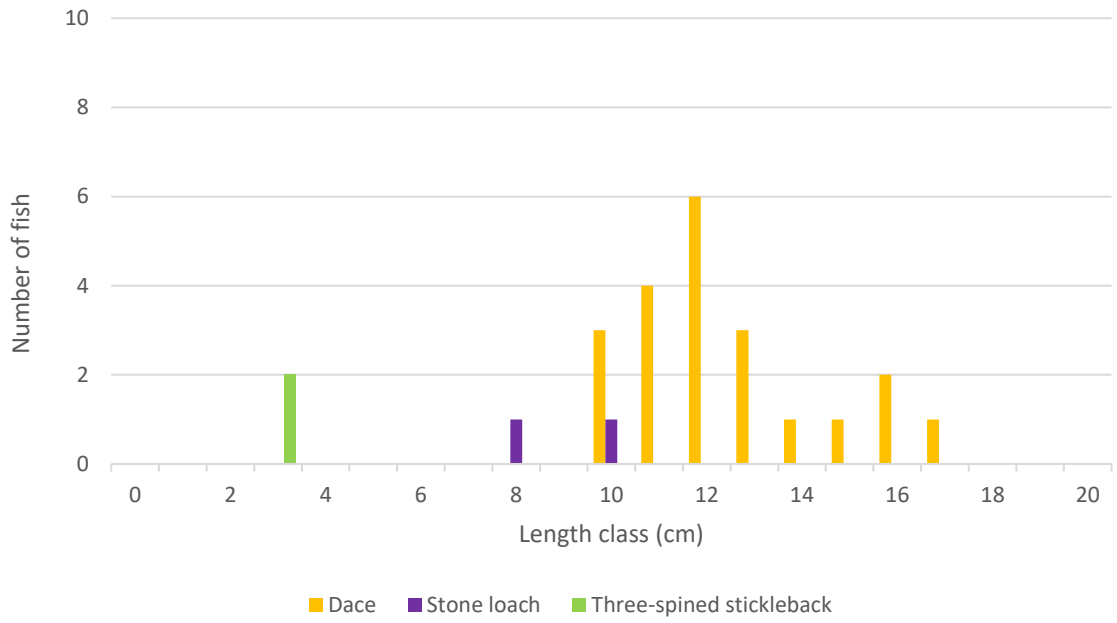

Figure 3.10 Fish length frequency distribution recorded via electro-fishing from site E5 on the River Blackwater, Fermoy Weir, July 2020.

3.5 eDNA analysis for shad species

Shad (*Alosa* spp.) eDNA was detected from water samples collected from the 'Kitchen Hole' site on the River Blackwater at Cappoquin on Thursday 21st May 2020 (all replicates from sites 4A, 4B & 4C; **Figure 3.11**). However, no detectable concentrations of shad eDNA were recorded in water samples taken on the same day upstream of Fermoy Weir (samples 1A, 1B, 1C), downstream of Fermoy Weir (2A, 2B, 2C) or downstream of Clondulane Weir (3A, 3B, 3C) on the River Blackwater. This indicated the absence of *Alosa* spp. from these locations during the peak spawning migration sampling period (**Figure 3.12**). The positive control samples from St. Mullin's on the River Barrow (sites 5A, 5B & 5C) all contained *Alosa* spp. DNA (**Figure 3.11**). All samples from all sampling locations yielded detectable brown trout (*Salmo trutta*) eDNA qPCR reactions (data not shown), demonstrating that all samples contained DNA that could be amplified successfully.

The concentrations of eDNA ranged from the lowest of 0.054ng/L in sample 5A at St. Mullin's to the highest of 1.442ng/L in the 4C sample from Kitchen Hole, Cappoquin. Average eDNA concentrations (across biological replicates) ranged from the lowest at in St. Mullin's (0.233 ng/L ±SD 0.152) to the highest at Kitchen Hole, Cappoquin (1.351, ±SD 0.079) ng/L). There was a significantly higher concentration of *Alosa* spp. eDNA in the Munster Blackwater (Kitchen Hole, Cappoquin) than in the samples from River Barrow (St. Mullin's) (**Figure 3.11**).

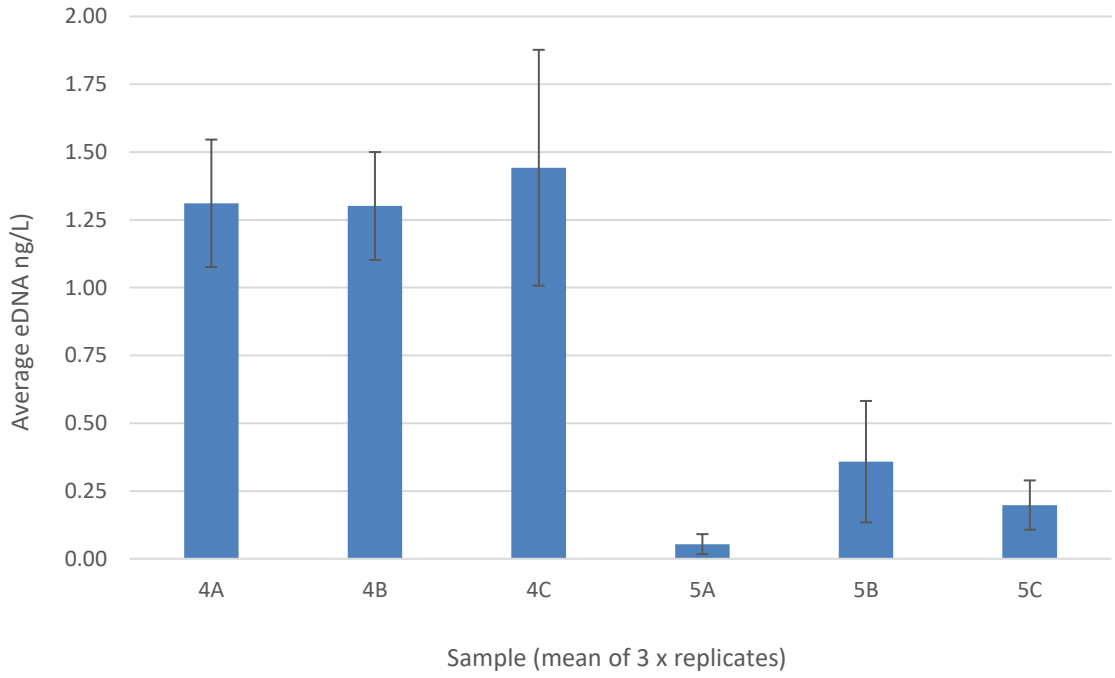

Figure 3.11 Average eDNA concentrations (ng/l) ±SD of *Alosa* spp. eDNA recorded in water samples from 'Kitchen Hole', River Blackwater and control site at St. Mullin's, River Barrow, May 2020

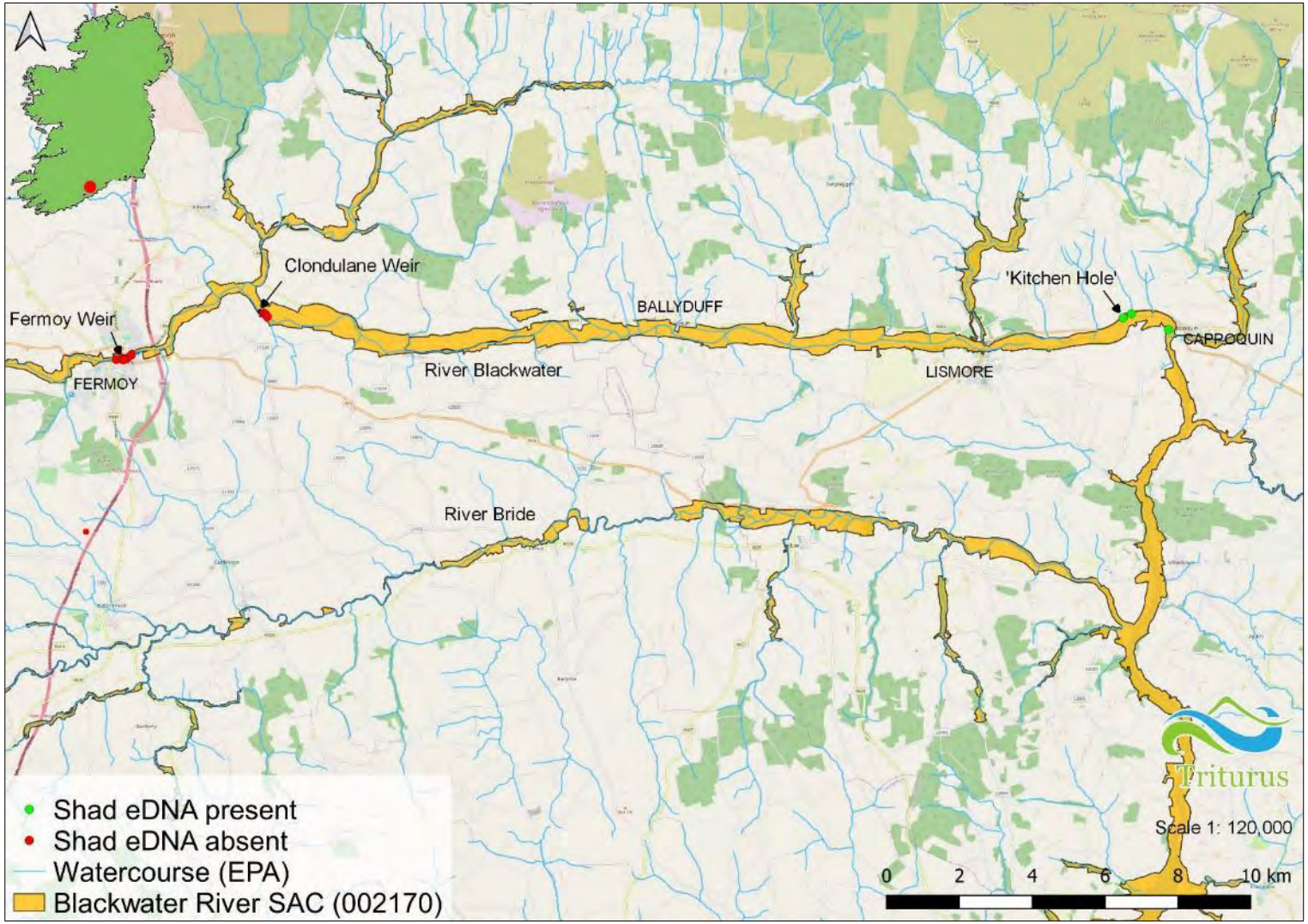

Figure 3.12 Shad species (*Alosa* spp.) eDNA presence/absence in the River Blackwater samples, May 2020 (River Barrow positive control site not shown)

3.6 White-clawed crayfish survey

A total of *n*=32 white-clawed crayfish were recorded from the survey area in May 2020 via sweep netting and hand searching (**Figure 3.13**). Furthermore, abundant crayfish remains were identified in numerous otter spraints in the vicinity of the weir. The majority of captured crayfish were adults although the presence of a low number of juveniles indicated a local breeding population.

The best quality crayfish habitat within the survey area was present in section C in the vicinity of Kent Bridge (particularly in the vicinity of the northernmost arches), where frequent cobble/boulder substrata and crevices offered good quality refugia. The areas downstream of the weir face and underneath Kent Bridge supported the greatest numbers of crayfish, as recorded by sweep netting/hand-searching and snorkelling (*n*=21). Low numbers of crayfish were recorded from survey sections A (*n*=2) and B (*n*=4), respectively, where boulder, large woody debris and the weir face provided suitable refugia (upstream of the weir). Low numbers of crayfish (*n*=5) were also captured from the downstream extent of the weir face in survey section D, with low densities also observed via snorkelling the deep weir pool.

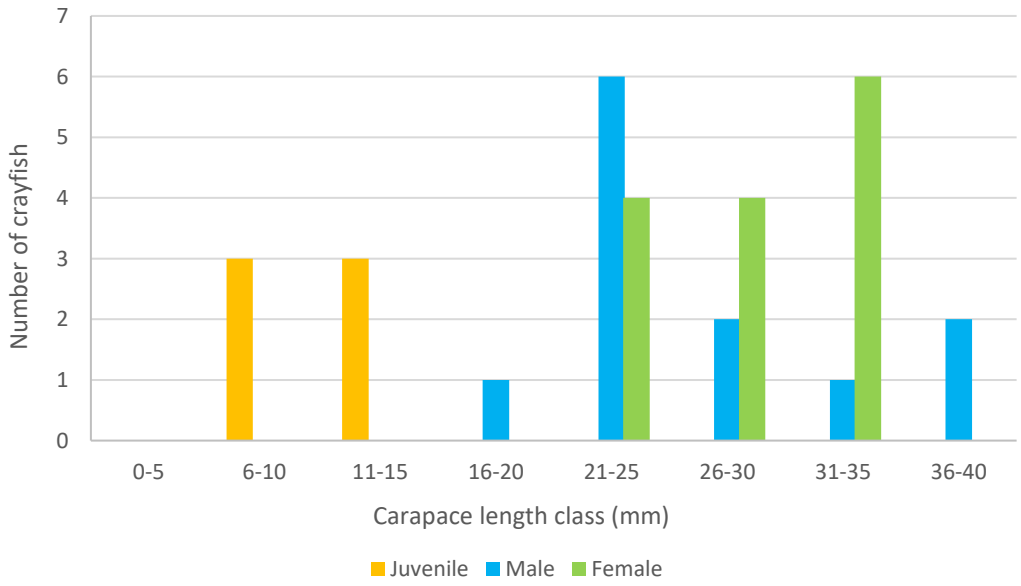

Figure 3.13 Carapace length class and sex distribution of *n*=32 white-clawed crayfish recorded in the vicinity of Fermoy Weir, 2020

Plate 3.10 White-clawed crayfish recorded via hand searching from survey section C, downstream of Fermoy Weir in the vicinity of Kent Bridge, May 2020

Plate 3.11 Dead freshwater pearl mussel (*Margaritifera margaritifera*) shell recorded on mid-channel island, downstream of Kent Bridge in May 2020

3.7 Freshwater pearl mussel survey

No live freshwater pearl mussels were found in the section of the River Blackwater within 100m upstream and downstream of Kent Bridge. Several empty shells, likely washed from upstream areas, were found in gravel/cobble deposits (**Plate 3.11**). Please refer to **Appendix A** for the accompanying freshwater pearl mussel survey report.

3.8 Otter survey

A total of *n*=11 otter signs were recorded from the survey area in the vicinity of Fermoy Weir during June-July 2020 (**Figure 3.14**). The majority of signs were spraints although three couch sites and a holt were also recorded. The existing weir structure was evidently an important resting/feeding area for otter, with very regular spraint sites present in addition to couch areas. The holt was located along the heavily-vegetated south bank of the River Blackwater, approx. 180m downstream of the weir face.

Plate 3.12 Very regular otter sprainting site (showing abundant white-clawed crayfish remains) recorded on the weir face downstream of Kent Bridge, July 2020

Figure 3.14 Otter sign distribution recorded in the vicinity of the proposed works area at Fermoy Weir, July 2020.

3.9 Biological water quality

A total of *n*=31 species across *n*=28 families were recorded in the *n*=4 Q-samples collected in July 2020. The samples S1 and S2 were collected upstream of the weir and S3 and S4 downstream of the weir. A summary of results is presented in **Table 3.1** and **Figure 3.15** below.

Following the methodology of Toner et al. (2005), the Environmental Protection Agency (EPA) group invertebrates into classes whereby pollution intolerant species are denoted class A, and species with greater pollution tolerance fall into successive classes (B through E, respectively). As such, the presence or absence of these groups and their relative abundance facilitates an assessment of biological river health. Good status (Q4) unpolluted water quality is achieved according to the EPA if at least one Group A taxon is present in, at least, fair numbers (5-10% total sample composition). Group B taxa may be common or absent and *Baetis rhodani* (large dark olive mayfly) is often dominant. Other Group C taxa are never excessive and group D / E taxa are present in small numbers or absent (Toner et. al., 2005). Our results are discussed in this context in order to interpret potential changes in the macroinvertebrate community composition.

The invertebrate samples (S1 & S2) collected upstream of the weir in addition to S4 downstream had moderate status (Q3-4) biological water quality. The recorded water quality was assigned due to small numbers of clean water indicator group A, Heptageniidae mayfly species and a dominance of EPA group B and C invertebrates (moderate water quality indicators). These included the group B mayfly species *Centroptilum luteolum*, and group C mayfly species, *Seratella ignita* and *Caenis rivulorum*.

A single sample (S3) had Q4 (good status), unpolluted water quality. The sample was well represented by EPA group A clean water indicator species with the stonefly species, *Isoperla grammatica* and two mayfly species present from the group (i.e. *Ecdyonurus insignis* and *Ephemera danica*).

No invertebrate species of higher conservation value than 'least concern' were recorded in the invertebrate assemblage when compared to national red lists (Feely et al. 2020; Kelly-Quinn & Regan, 2012; Byrne et al. 2009; Foster et al. 2009).

Table 3.1 Macro-invertebrate species composition and Q-ratings recorded on the River Blackwater in the vicinity of Fermoy Weir, July 2020

Family	Species	S1	S2	S3	S4	EPA group
Perlodidae	*Isoperla grammatica*			1		**A**
Heptageniidae	*Heptagenia sulphurea*	1				**A**
Heptageniidae	*Ecdyonurus insignis*		2	2		**A**
Ephemeridae	*Ephemera danica*			3	2	**A**
Baetidae	*Centroptilum luteolum*	5	6		3	**B**
Baetidae	*Baetis rhodani*			1		**C**
Ephemerellidae	*Serratella ignita*	9	8	10	2	**C**
Caenidae	*Caenis rivulorum*	14	4	16	3	**C**
Leptoceridae	*Athripsodes cinereus*	2		2	5	**B**
Limnephilidae	Not speciated - early instar	1				**B**
Hydropsychidae	*Hydropsyche siltalai*	4		2	14	**C**
Hydropsychidae	*Cheumatopsyche lepida*				4	**C**
Polycentropodidae	*Polycentropus flavomaculatus*	2	1	2		**C**
Dytiscidae	*Nebrioporus depressus*		1			**C**
Elmidae	*Limnius volckmari* larva			2	1	**C**
Elmidae	*Elmis aenea* larva	2				**C**
Neritidae	*Theodoxus fluviatilis*	5				**C**
Bithyniidae	*Bithynia tentaculata*	2	7	1		**C**
Planorbidae	*Planorbis planorbis*		2			**C**
Valvatidae	*Valvata piscinalis*	3	3			**C**
Physidae	*Physa fontinalis*		2			**D**
Sphaeriidae	*Pisidium* sp.	1				**D**
Lymnaeidae	*Radix balthica*	6	1	3	1	**D**
Sphaeriidae	*Sphaerium corneum*		2			**D**
Hirudinidae	*Pisciola geometra*			2		**C**
Gammaridae	*Gammarus duebeni*	2	8	4	8	**C**
Assellidae	*Asellus aquaticus*	5	1	4	9	**D**
Simulidae	Not speciated				2	**C**
Chironomidae excl. *Chrionomus* sp.	Not speciated	5	6		6	**C**
Hydrachnidiae	Not speciated	1		1		**C**
Oligochaeta	Not speciated			2	2	**n/a**
Taxon richness		**18**	**15**	**17**	**14**	
Total abundance		**70**	**54**	**58**	**62**	
Q Rating		**Q3-4**	**Q3-4**	**Q4**	**Q3-4**	
WFD Status		**Mod**	**Mod**	**Good**	**Mod**	

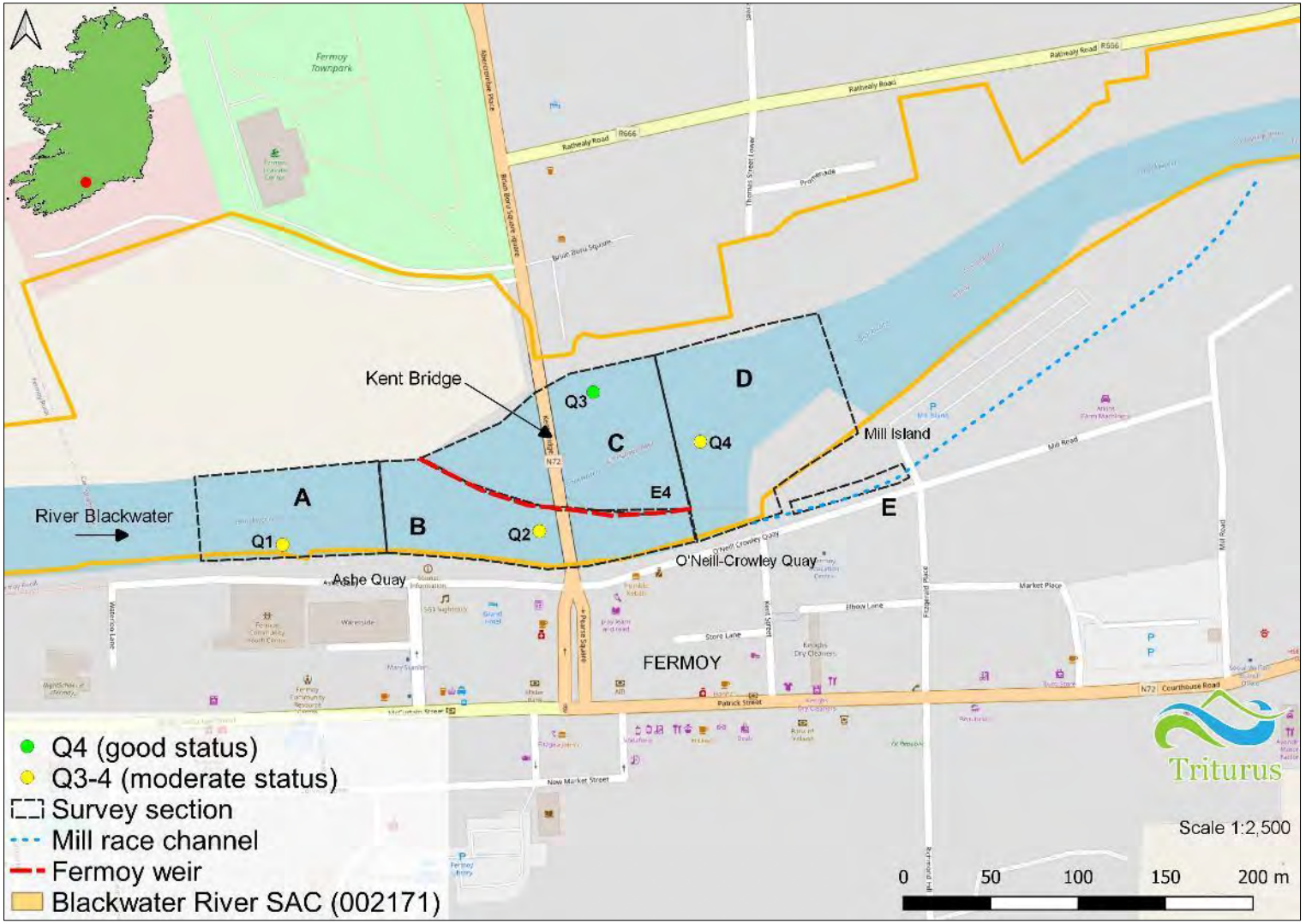

Figure 3.15 Biological water quality (Q-ratings) recorded in the vicinity of Fermoy Weir, July 2020.

3.10 Aquatic ecological evaluation

An ecological evaluation of the survey area was based on the results of the aquatic surveys. All aquatic survey areas on the River Blackwater (i.e. sections A-D) were considered of **International importance** given they formed part of the Blackwater River SAC (002170). These survey sections were also considered of high value given the presence of qualifying interest *Lampetra* sp. ammocoetes, Atlantic salmon, white-clawed crayfish and otter in addition to the Annex I habitats 'Water courses of plain to montane levels, with submerged or floating vegetation of *Ranunculion fluitantis* and *Callitricho-Batrachion* or aquatic mosses [3260]' (sections C and D) 'Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels [6430]' (sections C and D).

The mill race channel (survey section E) was located outside of the Blackwater River SAC boundary. However, given that the channel supported otter and herbaceous vegetation representative of the Annex I habitat 'Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels [6430]', survey section E was considered of **local importance (high value)**.

4. Discussion

The baseline surveys focused on aquatic habitats in relation to Blackwater River SAC qualifying interest Atlantic salmon, twaite shad, lamprey species, white-clawed crayfish, freshwater pearl mussel, otter and floating river vegetation habitat, in addition to biological water quality (macro-invertebrates) and general aquatic ecology. The Fermoy Weir survey area was found to be of high value for Atlantic salmon, European eel and lamprey species (downstream of the weir in particular) and evidently supported otter, white-clawed crayfish and two Annex I aquatic habitats. No freshwater pearl mussels were recorded from the survey area.

4.1 Most valuable areas

4.1.1 Atlantic salmon

Although Atlantic salmon (and brown trout) were recorded upstream (site E1) and downstream (E2, E4) of Fermoy Weir, the best-quality salmonid habitat was present downstream (i.e. survey sections C and D). The northern extent of these sections (along the north bank of the river) was a particularly good nursery for salmonids (*Ranunculus*/macrophyte zone) and also offered some good-quality spawning substrata. Likewise, spawning habitat was good throughout much of the main channel in both sections C and D. Some excellent quality adult salmonid holding habitat was present in the large weir pool in addition to the deeper glide habitat downstream of the pool. Upstream of the weir (slower-flowing deep glide) also provided good holding habitat for migrating adults although this area was more suited to a range of coarse fish species such as dace, roach and minnow. The quality of salmonid habitat was very good overall although three of the four biological water quality samples were not meeting 'good status' WFD targets (i.e. Q3-4, moderate status, slightly polluted).

4.1.2 Lamprey

Survey sections C and D (downstream of Fermoy Weir) were of high value for *Lampetra* sp. lamprey, with both suitable spawning and ammocoete habitat present. The margins and littoral area of river islands downstream of Kent Bridge were provided the most suitable ammocoete habitat within the study area. Here, accumulations of fine, organic-rich soft sediment required by both larval river/brook and sea lamprey (Goodwin et al., 2008; Aronsuu & Virkkala, 2014) were present, varying in sediment depths of 5-15cm. Three such areas targeted for lamprey ammocoetes in close proximity to these islands (site E3), supported densities of 10.5, 12 and 15 *Lampetra* sp. ammocoetes per m^2, respectively. These densities compared favourably with the conservation objective of "Mean catchment juvenile density of brook/river lamprey at least 2/m^2" for *Lampetra* sp. in the Blackwater River SAC (NPWS, 2012). Some suitable (though sub-optimal) ammocoete habitat was also present in association with macrophyte beds in these survey sections, although this was more limited in extent than the aforementioned island margins. Suitable lamprey spawning areas (ranging from finer gravels to larger cobbles) were present throughout survey sections C and D, with the slow, deeper glide upstream of the weir less suitable. A known historical sea lamprey and river lamprey spawning site was present in survey section D (tailing of large weir pool; NPWS data).

4.1.3 Twaite shad

Analysis of water samples for *Alosa* spp. eDNA during the species' known peak spawning migration (21st May 2020) supported the absence of shad from the River Blackwater upstream and downstream of Fermoy Weir and downstream of Clondulane Weir (**Figure 3.12**). However, *Alosa* spp. eDNA was detected from water samples collected from the 'Kitchen Hole' site on the lower (tidal) River Blackwater at Cappoquin. Our genetic results support the suspected distribution of shad species (majority considered to be twaite shad, *Alosa fallax*) within the River Blackwater, i.e. present to the tidal limit (King & Linnane, 2004; King & Roche, 2008).

Two records exist for allis shad (incidental rod and line captures) on the River Blackwater at Careysville (below Clondulane Weir) in 2003 and 2005, some 25km upstream of the tidal limit (King & Linnane, 2004; NPWS data) - the furthest upstream record for shad species in the River Blackwater SAC. Whilst allis shad are known to penetrate further up river catchments compared to twaite shad (Maitland & Hattin-Ellis, 2003; Jolly et al., 2012), the Clondulane Weir would appear to be an impassable barrier to both shad species in the River Blackwater, based on eDNA analysis. Unlike salmonids, weaker-swimming shad species are unable to traverse many instream barriers (Larinier & Travade, 2002). However, given their propensity for spawning in the lower (tidal) reaches of rivers, irrespective of upstream passage issues, twaite shad populations are often less impacted by barriers than other anadromous species (van Puijenbroek et al., 2018).

4.1.4 White-clawed crayfish

Despite being historically present in only the Awbeg River within the Munster Blackwater catchment, current white-clawed crayfish distribution is known from several other tributaries as well as the Blackwater main channel, both upstream and downstream of Fermoy (Smiddy & Saich, 2015). Moderate numbers of white-clawed crayfish were recorded from the vicinity of Fermoy Weir during the 2020 survey (*n*=32 total), including both adults and juveniles. The areas of channel underneath Kent Bridge (section C) represented the best quality crayfish habitat within the survey area, with ample boulder/cobble refugia present. These areas also supported the highest density of crayfish recorded. However, areas along the existing weir face (boulder-dominated habitat with frequent crevices) also provided valuable refugia for the species. The low densities of crayfish recorded from survey sections A, B and D reflected the difficulty in surveying these areas (deeper/faster water) rather than poor suitability. This was supported via snorkelling surveys of these areas which observed crayfish in deeper areas.

4.1.5 Freshwater pearl mussel

No live freshwater pearl mussels were found in the section of the River Blackwater within 100m upstream and downstream of Kent Bridge. The only habitat within 100m of the bridge that could be considered suitable for freshwater pearl mussels was located in survey section D, downstream of the large weir pool along the north bank of the river (i.e. fast glide with clean, cobble-dominated substrata) (**Appendix A**). Several empty shells, likely washed from upstream areas, were found in gravel/cobble deposits (**Plate 3.11**). Four live individuals recorded in 2011 were not present given changes in substrata and local hydrology (i.e. partial weir collapse). A reproducing population at this location was not considered possible given water quality issues (i.e. ≤Q4; **Table**

3.1). The changing morphology of the channel due to breaching of the weir and significant movement of gravels may also have impacted the small residual historical population.

Please refer to **Appendix A** for the accompanying freshwater pearl mussel survey report.

4.1.6 Otter

The Fermoy Weir survey area was evidently of high-value for otter, with a total of *n*=11 signs recorded during June-July 2020 (**Figure 3.14**). A single holt was located within the survey area approx. 180m downstream of the weir, on the heavily-vegetated south bank of the River Blackwater. The existing weir face was a regularly used feeding and resting area (i.e. couches). The presence of abundant white-clawed crayfish remains in multiple recorded spraints (e.g. Plate 3.12) indicated the prevalence of this prey species in the diet of local otter population. In turn, this highlighted the importance of areas with ample crayfish refugia (such as the weir face and underneath Kent Bridge) in supporting foraging otter. The highly-seasonal dietary link between white-clawed crayfish and otter has been frequently noted elsewhere in Ireland (pers. obs.; Kyne et al., 1989; Breathnach et al., 1993; Ottino & Giller, 2004; Reid et al., 2013) including within the Blackwater River SAC (Smiddy & Caich, 2015).

4.1.7 Floating river vegetation

Macrophyte communities representative of the Annex I habitat ‘‘Water courses of plain to montane levels, with submerged or floating vegetation of *Ranunculion fluitantis* and *Callitricho-Batrachion* or aquatic mosses [3260]’ (‘floating river vegetation’, FRV) were present within the River Blackwater survey area. Sections C and D, downstream of Fermoy Weir, supported frequent *Ranunculus* subspecies *Batrachion* agg. in addition to other indicator species (EC, 2013) including Callitriche sp., *Myriophyllum spicatum* and the moss *Fontinalis antipyretica*. The better-quality areas of FRV habitat could be considered as those featuring an overall higher percentage cover, i.e. survey section C downstream of Kent Bridge, along the north bank. Given the paucity of macrophytes, no good examples of this Annex I habitat were present upstream of the weir (survey sections A and most of B).

4.1.8 Hydrophilous tall herb habitat (non-qualifying interest)

Of note, several vegetated gravel islands located in the River Blackwater downstream of Fermoy Weir supported the non-qualifying interest Annex I habitat ‘Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels [6430]’. A number of positive indicator species (EC, 2013; Devaney et al., 2013) were recorded on exposed gravel shoals and their margins including *Epilobium hirsutum*, *Lythrum salicaria*, *Mentha aquatica*, *Myosotis scorpioides, Stachys palustris* and *Alisma plantago-aquatica*. River gravel islands (bars) are classified as vulnerable in the European Red List of Habitats, based on the criterion of a large reduction in the habitat area over the last 50 years (about 35%; Janssen et al., 2016). Such islands are ephemerally inundated at higher flows and subject to wetting and drying processes with changing water levels, thereby alternately offering terrestrial, wet and aquatic habitats (Zeng et al., 2015). Gravel bars and partially vegetated islands, such as those found downstream of Fermoy Weir, are key components of gravel-bed rivers (Edwards et al., 1999; Tockner et al., 2006) and are naturally highly dynamic

and morphologically complex systems. Therefore, gravel islands represent important instream habitat at the aquatic-terrestrial interface. In having an ecotonal position between aquatic and terrestrial environments, bars have the potential to support a varied and rich biota (Kalníková et al., 2020; Gilvear et al., 2007).

Good examples of the Annex I hydrophilous tall herb habitat was also present in the mill race channel (survey section E), located outside of the Blackwater River SAC boundary, as well as along the northern river margins of survey section C (downstream of the bridge) and to the south of the large gravel island near Mill Island (section D).

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6. Appendix A – freshwater pearl mussel survey report

* Report attached separately

7. Appendix B – assorted survey images

Plate 7.1 Juvenile brown trout (top) and Atlantic salmon parr (bottom) recorded from electro-fishing site E1 on the River Blackwater upstream of Fermoy Weir, July 2020

Plate 7.2 European eel observed in boulder habitat underneath Kent Bridge (electro-fishing site E2) on the River Blackwater, July 2020

Plate 7.3 Targeted lamprey ammocoete survey in area A of site 5 on the River Blackwater downstream of Kent Bridge, July 2020

Plate 7.4 Different age classes of *Lampetra* sp. ammocoetes recorded from area B of site E3 on the River Blackwater, July 2020

Plate 7.5 European eel elver captured from sediment accumulation in area A of site E3

Plate 7.6 Atlantic salmon parr recorded from site E4 on the River Blackwater, July 2020

Plate 7.7 Juvenile and adult dace recorded from site E5, July 2020

Plate 7.8 River island vegetation representative of the Annex I habitat 'Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels [6430]', located downstream of Fermoy Weir

Triturus Environmental Ltd.

42 Norwood Court,

Rochestown,

Co. Cork,

T12 ECF3.

Appendix 3. A Survey of Freshwater Pearl Mussel (*Margaritifera margaritifera*) at Fermoy Bridge on the Munster Blackwater River, Co. Cork

A Survey of

The Freshwater Pearl Mussel (*Margaritifera margaritifera*)

at Fermoy Bridge on the Munster Blackwater River, Co. Cork.

May 2020

Sweeney Consultancy,
Rahan,
Mallow
Co. Cork.
Tel. 022/26780

TABLE OF CONTENTS

1. INTRODUCTION

The freshwater pearl mussel (*Margaritifera margaritifera*) is on the IUCN Invertebrate Red Data List and is protected under the Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention). It is protected by law in Ireland under the 1976 Wildlife Act (S.I. 112, 1990) and is listed on Annex II and Annex V of the EU Habitats Directive (92/43/EEC).

Sweeney Consultancy was contracted to carry out surveys for freshwater pearl mussels from 100m upstream (ITM 581030 598585) to 100m downstream (ITM 581296 598660) of Fermoy Bridge, on the Munster Blackwater River, where repair works are proposed.

2. SURVEY METHODOLOGY

The survey was carried out under Licence No. C15/2020, issued by the National Parks and Wildlife Service. The survey methodology used was in accordance with the guidelines given in Irish Wildlife Manual No. 12, NPWS (Anon., 2004). Surveying was carried out on May 29, 2020, in bright weather, with good visibility.

Following an initial safety inspection and photographing of the stretch of river to be surveyed, Pascal Sweeney examined the riverbed visually, with a bathyscope and by snorkelling, depending on water depth. Biosecurity measures were strictly adhered to, with all equipment in contact with river water washed down with Virkon Aquatic disinfectant between sites. Notes were taken on the aquatic habitat conditions and suitability for freshwater pearl mussels, based on the criteria of Hastie *et al.* (2000) and Skinner *et al.* (2003).

3. RESULTS

3.1 River Habitat

Because Fermoy Weir crosses under the bridge and this weir is breached downstream of the bridge (Photo 1), the instream physical conditions vary considerably.

Photo 1: Fermoy Bridge and Weir, downstream view (Arches numbered from LHS to RHS)

Upstream of Arches 1 to 4, from the weir to the bridge, there is currently no flow (Photo 2), due to a break in the weir on the right-hand side downstream of the bridge. Upstream of the weir there is deep water with silted substratum. The habitat here is unsuitable for freshwater pearl mussels.

Photo 2: Upstream of Arches 1 to 4

The fish pass (now dry) on the weir is upstream of Arch 5 (Photo 3).

Photo 3: Dry fish pass upstream of Arch 5

The river upstream of Arches 6 and 7 is deep glide above of the weir (Photo 4). The habitat here is unsuitable for freshwater pearl mussels.

Photo 4: Upstream of Arches 6 & 7

For 50m downstream of Arches 1 to 3, there is slow shallow glide over silted gravel and cobble, with approximately 20% cover of water crowfoot (*Ranunculus spp.*) (Photo 5). The habitat here is unsuitable for freshwater pearl mussels.

Photo 5: Downstream of Arches 1 to 3

Vegetated gravel islands occur in the central part of the river downstream of Arches 3 and 4 (Photo 6).

Photo 6: Vegetated gravel islands

Downstream of Arches 4 and 5, there is a slow back-currant from the strong flow at the broken section of the weir (Photo 7). The habitat here is unsuitable for freshwater pearl mussels.

Photo 7: Downstream of Arch 5

The 50m of river downstream of Arches 6 and 7 consists of fast turbulent run above the weir (Photo 8). The habitat here is unsuitable for freshwater pearl mussels. The water then passes through the breach in the weir and flows strongly over to the left hand side of the river (Photo 9), around a large bank of cobble that originated from the broken weir (Photo 10). This flow by the left bank is the only habitat within 100m of the bridge that could be considered suitable for freshwater pearl mussels (Photo 11).

Photo 8: Downstream of Arches 6 & 7

Photo 9: Flow from break in weir to left-hand side of river channel

Photo 10: Cobble bank from broken weir by right bank

Photo 11: Flow on left-hand side of river channel downstream of bridge

3.2 Freshwater Pearl Mussel Survey Results

In the survey carried out on 29/05/2020, no live freshwater pearl mussels were found in the section of the River Blackwater within 100m upstream and downstream of Fermoy Bridge. A few empty shells, washed down from upstream were found in gravel/cobble deposits.

4. COMMENTS

In 2011, Sweeney Consultancy was involved in survey work additional to the EIS for the Munster Blackwater River (Fermoy) Drainage Scheme for OPW. Four live freshwater pearl mussels were recorded, along the right bank adjacent to the Plomeur car park, approximately 250m downstream of the bridge. This location is now covered in a deep layer of stone from the broken weir (Photo 10).

The freshwater pearl mussel can live for over 100 years and requires very good water quality (Skinner *et al.,* 2003). The NS2 Project (2010) shows the main population of freshwater pearl mussels in the Blackwater occurring upstream of Mallow. Downstream of Mallow, freshwater pearl mussels have occasionally been recorded. Individual mature mussels are carried downstream in floods and settle in deep water, but are probably unlikely to successfully reproduce (Evelyn Moorkens *pers. comm.*). The empty shells found on 29/05/2020 could have originated much farther upstream. There is no suitable freshwater pearl mussel habitat from c. 500m downstream of Fermoy Bridge to Clondulane Weir over 5km downstream. In a survey carried out by Sweeney Consultancy for Inland Fisheries Ireland on 03/07/2016 from Clondulane Weir to Kilmurry Island, c. 5km farther downstream, no freshwater pearl mussels were recorded in the survey carried out. This survey was repeated on 19/09/2019 and again no mussels were found. In the past, NPWS staff have found a few individual mussels downstream of Clondulane Weir (Cyril Saich, *pers. comm.*). Given that Moorkens (2006) states that a reproducing pearl mussel population requires very high water quality, with phosphorus levels lower than the median level associated with EPA Q5 waters, and that since 1975, EPA have only recorded a Q-value above Q4 at one site downstream of Fermoy on one occasion, a reproducing population here is not possible.

5. REFERENCES

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Appendix 4. Tree survey and arboricultural impact assessment

TREE SURVEY AND ARBORICULTURAL IMPACT ASSESSMENT

FERMOY WEIR DEVELOPMENT, FERMOY, CO. CORK.

PLANNING REF .

SURVEY AND REPORT BY:

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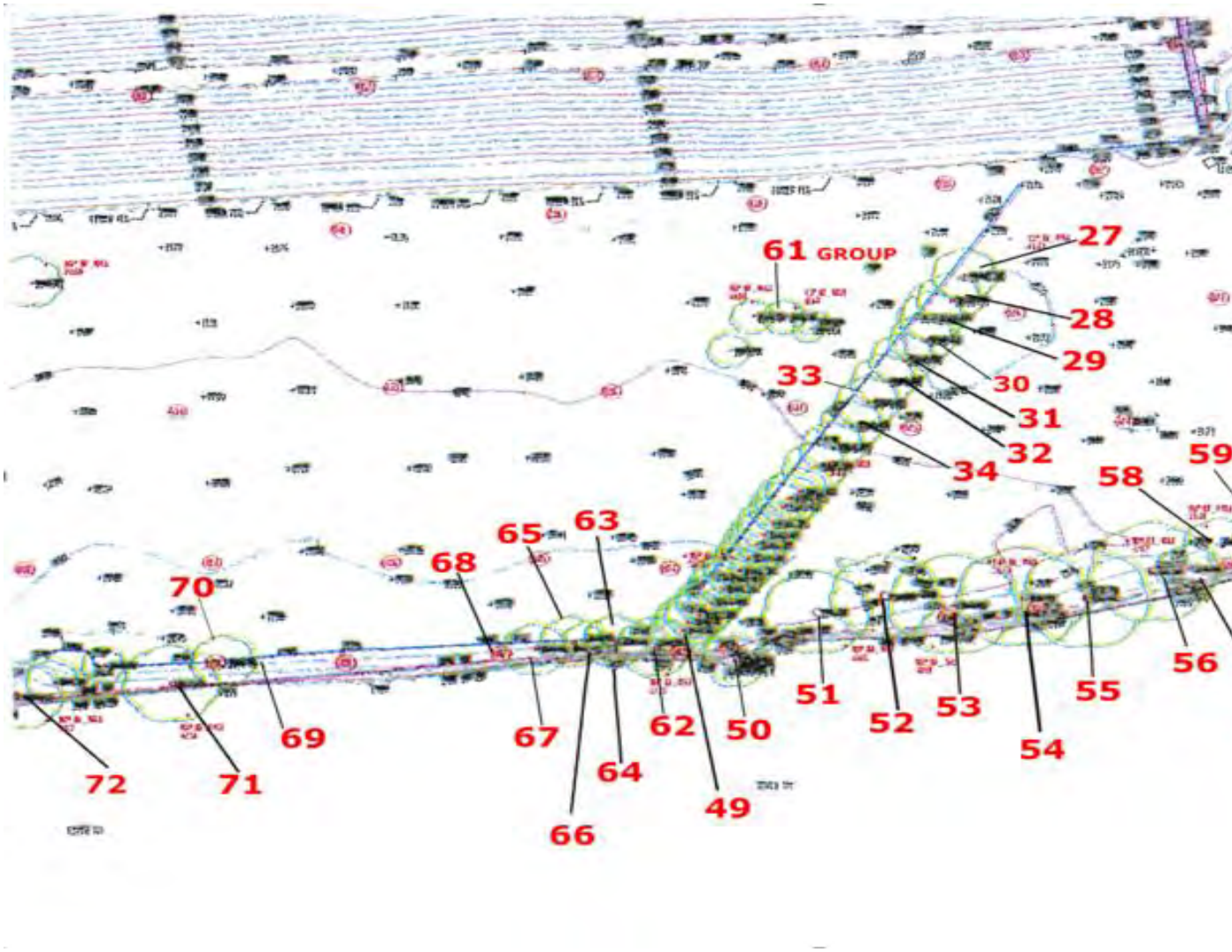


STATEMENT OF AUTHORITY

The author, Mark Donnelly, holds a BSc. Hons in Forestry from Bangor University, Wales, and is a member of the Institute of Chartered Foresters. He worked as an arboricultural consultant for the National Trust in Wales for 22 years and has worked as a lecturer in Forest Ecology at Bangor University. In Ireland, he has undertaken a range of arboricultural and ecological surveys for projects including wind farms, quarries, local authorities, housing developments, roads and pipelines.

REPORT LIMITATIONS

The statements, findings and recommendations made within the report do not take into account any effects of extreme climate and weather incidences, vandalism, changes in natural and built environment around the trees after the date of this report nor any damage whether physical, chemical, or otherwise. Mark Donnelly cannot accept any liability in connection with the above factors, nor where recommended tree management is not carried out in accordance with modern tree care techniques.

The tree inspection is by visual observation on ground level and may be compromised by climbing plants, particularly ivy obscuring defects, and the time of year that the survey is carried out, for example, many decay fungi can only be observed seasonally.

INTRODUCTION

The report was prepared as part of a planning application to Cork County Council for construction of a new fish pass and restoration of the existing weir in Fermoy town.

The aims of the report are:

1) To establish a baseline tree survey and description of the trees on the site with particular regard to safety management recommendations and an Arboricultural Method Statement.

2) To provide an assessment of arboricultural impacts for the proposed development..

3) To identify trees to be retained and provide recommendations for their management.

SITE DESCRIPTION

GPS Grid Reference 52.13928 – 8.27673

The site is adjacent to the river Blackwater in the centre of Fermoy town. The trees are on the north bank upstream of Fermoy Bridge close to the existing weir and fish pass. It is a dry site with course loamy drift soil and siliceous stones but it is liable to flooding as it is below the towns flood defences and part of a recreational area, open to the public. It is within the Blackwater River SAC (002170).

METHODOLOGY

The trees were surveyed on 31st July 2021. They were described and recorded as individual trees and there is one group. All were numbered and tagged with their locations marked on the site drawing. (Maps 2and3 appendix). Tree numbers marked on the map should be prefixed by 148. Visual assessment follows the standards in BS 5837 (2012). Trees in relation to design, demolition and continuation.

Table 1: SURVEY KEY

1.	**Tree Numbers**	Individual tree and Tree Groups (prefixed with G) have numbers to facilitate location on the site plan.		
2.	**Species**	Recorded with common name		
3.	**Age**	**IM**	An immature tree	greater than 150 mm diameter but regarded as a sapling
		SM	Semi mature	a young tree but less than 50 % of its ultimate size
		M	Mature	a tree having attained dimensions typical of a fully-grown specimen of its species
		OM	Over Mature	An old specimen of a species showing signs of decline in health. Usual symptoms include crown starting to break up and decreasing in size.
4.	**Girth**	Stem diameter (at approximately 1.3 m above ground) in mm		
5.	**Height**	Approximate tree height in meters.		
6.	**Spread**	Crown spread in meters.		
7.	**Condition**	**Good**	Full healthy canopy with good form and health	
		Fair	A specimen whose overall condition is typical of the site and may exhibit slightly reduced leaf cover/minor deadwood or may be predisposed to defects, e.g., Coppiced growth, but otherwise in good health.	
		Poor	A specimen which through defect or disease has a limited longevity or may be unsafe.	
8.	**Comments**	Any information relating to trees condition not covered previously and recommendation for removal/retention.		
9.	**Recommendation**	General recommendations for retention, felling/removal and tree surgery.		
10.	**Tree Retention Category**	**A**	Indicates a tree of high quality and a good example of their species and of significant landscape value. Should contribute significantly to their environs for a minimum of 40years.	
		B	Indicates a tree of moderate quality and value. Should contribute significantly for at least 20 years.	
		C	Indicates a tree of low quality and value, that could contribute for at least 10 years.	
		U	Indicates a tree of poor condition that should not be retained for more than 10 years.	
11.	**RPA**	Root Protection Area as a radius measured from the tree centre in meters. RPA is the minimum radial range of tree protection necessary to safeguard trees roots and would normally be the same as the "Construction Exclusion Zone" enclosed by fencing during construction. The RPA is calculated as follows: <u>Single stem tree:</u> RPA radius – stem diameter x .12 (See Root Protection Area Table). <u>Trees with more than one stem arising below 1.50m above ground level:</u> RPA radius – equivalent resultant combined stem diameter for multi-stemmed trees.(RPA calculation is capped at 5 stems)		

Table 2: ROOT PROTECTION AREAS

Single stem diameter (mm)	Radius of nominal circle (m)	RPA (m^2)	Single stem diameter (mm)	Radius of nominal circle (m)	RPA (m^2)
75	0.9	3	675	8.1	206
100	1.2	5	700	8.4	222
125	1.5	7	725	8.7	238
150	1.8	10	750	9	255
175	2.1	14	775	9.3	272
200	2.4	18	800	9.6	290
225	2.7	23	825	9.9	308
250	3	28	850	10.2	327
275	3.3	34	875	10.5	346
300	3.6	41	900	10.8	366
325	3.9	48	925	11.1	387
350	4.2	55	950	11.4	408
375	4.5	64	975	11.7	430
400	4.8	72	1000	12	452
425	5.1	81	1025	12.3	475
450	5.4	92	1050	12.6	499
475	5.7	102	1075	12.9	519
500	6	113	1100	13.2	547
525	6.3	124	1125	13.5	573
550	6.6	137	1150	13.8	598
575	6.9	150	1175	14.1	625
600	7.2	163	1200	14.4	652
625	7.5	177	1225	14.7	679

Table 3: INDIVIDUAL AND GROUP TREE DETAILS

No.	Species	Age Class	Girth	Height	Spread (m)	Condition	Tree Retention Category	Comments	Recommendations	Recommendations Compatible with proposed design
18427	Black poplar	M	700	25	13	Good	A	All topped at 6m in 2000 Row of trees 2-3m spacing **NOTE: TREES 34-49 ARE NOT ARE NOT MARKED ON THE SITE MAP.** Similar spread 10-13m Similar condition	Retain	Yes
18428	Black Poplar	M	500	25	12	Good	A		Retain	Yes
18429	Black poplar	M	550	25	12	Good	A		Retain	Yes
18430	Black Poplar	M	500	25	12	Good	A		Retain	Yes
18431	Black poplar	M	550	25	12	Good	A		Retain	No
18432	Black Poplar	M	530	25	12	Good	A		Retain	No
18433	Black poplar	M	600	25	12	Good	A		Retain	No
18434	Black Poplar	M	600	25	10	Good	A		Retain	No
18435	Black poplar	M	500	25	12	Good	A		Retain	No
18436	Black Poplar	M	520	25	10	Good	A		Retain	No
18437	Black poplar	M	500	26	10	Good	A		Retain	No
18438	Lawson's Cypress	SM	-	-	-	Dead	-		Fell	Yes
18439	Black Poplar	M	420	26		Good	A	Poplar same as 18427-18437	Retain	No
18440	Lawson's Cypress	-	-			Dead	-		Fell	No

No.	Species	Age Class	Girth	Height	Spread (m)	Condition	Tree Retention Category	Comments	Recommendations	Recommendations Compatible with proposed design
18441	Black poplar	M	450	26	10	Good	A	Poplar same as 27-37	Retain	No
18442	Lawson's Cypress	SM	350	13	8	Poor	V		Fell	Yes
18443	Black Poplar	M	480	26	10	Good	A		Retain	No
18444	Lawson's Cypress	SM	350	12	8	Poor	V	Suppressed	Fell	Yes
18445	Black Poplar	M	400	26	10	Good	A		Retain	No
18446	Lawson's Cypress	SM	350	13	8	Poor	V		Fell	Yes
18447	Black Poplar	M	450	25	10	Good	A		Fell	No
18448	Lawson's Cypress	M	350	13	8	Poor	V	Supressed	Fell	Yes
18449	Black Poplar	M	500	26	10	Good	A	Suppressed	Retain	Yes
18450	Alder	M	250	9	12	Fair	B	Multi-stemmed 5 stems. At end of weir	Retain	Yes
18451	Lime	M	1000	19	20	Good	A	Large well-proportioned tree	Retain	No
18452	Lime	M	1000	19	20	Good	A	Large well-proportioned tree	Retain	No
18453	Norway Maple	SM	400	16	16	Fair	B	May collapse but good	Retain	No
18454	Lime	SM	300	14	10	Good	A	Suppressed tree but good form	Retain	No
18455	Norway Maple	SM	410	15	16	Poor	C	Broken crown	Fell	Yes
18456	Lime	M	1000	19	16	Good	A	Extensive epicormics	Retain	No
18457	Lime	SM	250	15	15	Poor	V??	Multi-stemmed	Retain	No
18458	Lime	SM	300	15	10	Fair	B		Retain	No
18458a	Ash	SM	250	11	10	Poor	V	Not tagged Multi-stemmed ???	Fell	Yes
18459	Norway Maple	SM	350	17	18	Poor	V	Forked	Fell	Yes

No.	Species	Age Class	Girth	Height	Spread (m)	Condition	Tree Retention Category	Comments	Recommendations	Recommendations compatible with proposed design
18460	Lime	M	1000	19	17	Good	A	Epicormics	Retain	No
18461	Black poplar	IM	180	11	10	Good	A	Group of suckers x 6 max. diameter 180	Retain	No
18462	Black poplar	M	600	25	12	Good	A	(end of line) on riverbank	Retain	No
18463	Lombardy poplar	M	380	18	6	Good	B		Fell	Yes
18464	Alder	M	550	8	10	Poor	B	Over mature (biodiversity value)	Retain	Yes
18465	Lombardy Poplar	M	350	16	6	Good	B		Fell	Yes
18466	Lombardy poplar	M	350	16	6	Good	B	(close to dead mature elm)	Fell	Yes
18467	Alder	M	650	12	12	Fair	B	Several main stems over river	Retain	Yes
18468	Alder	M	500	12	10	Fair	B	Over river	Retain	Yes
18469	Lime	IM	200	10	6	Good	A	Regrowth	Retain	Yes
18470	Lime	M	900	18	11	Good	A		Retain	Yes
18471	Lime	M	900	16	12	Fair	B	Leaning over river (other half)?	Retain	Yes
18472	Black poplar	M	700	21	10	Good	A		Retain	No
18473	Black poplar	M	800	22	10	Good	A		Retain	No
18474	Lime	IM	200	8	6	Good	A	Regrowth from other tree	Retain	No
18475	Lombardy poplar	M	450	18	8	Good	B		Fell	Yes
18476	Lombardy poplar	M	350	10		Dead	B		Fell	Yes
18477	Norway Maple	M	400	16	10	Poor	B	Forked	Fell	Yes

No.	Species	Age Class	Girth	Height	Spread (m)	Condition	Tree Retention Category	Comments	Recommendations	Recommendations compatible with proposed design
18479	Norway Maple	M	400	16	10	Good	A		Retain	No
18480	Norway Maple	M	400	15	12	Good	B	Weak crown	Retain	No
18481	Alder	M	420	14	10	Fair	B	Over river	Retain	No
18482	Norway maple	SM	300	16	10	Fair	B	Poor branching	Fell	Yes
18483	Norway maple	SM	300	15	10	Fair	B	Forked	Fell	Yes
18484	Black poplar	M	750	22	12	Good	A		Retain	Yes
18485	Norway Maple	M	480	16	11	Fair	B	Forked	Retain	Yes
18486	Sycamore	SM	500	16	11	Good	A		Retain	Yes
18487	Norway Maple	SM	400	16	12	Fair	B	Forked	Retain	Yes
18488	Norway Maple	SM	350	18	13	Fair	B	Forked	Retain	Yes
18489	Norway maple	M	480	16	13	Fair	B	Poor branching	Retain	Yes
18490	Norway maple	SM	400	17	14	Fair	B	Poor branching	Retain	Yes
18491	Norway maple	SM	350	15	12	Fair	B	Poor branching	Retain	Yes
18492	Black poplar	M	900	25	12	Good	A		Retain	Yes
18493	Norway maple	M	480	14	12	Good	A		Retain	Yes
18494	Norway Maple	M	480	14	12	Fair	B	Poor branching	Retain	Yes
18495	Black poplar	M	550	23	13	Good	A		Retain	Yes
18496	Norway Maple	M	400	15	12	Fair	B	2 stems	Fell	Yes
18497	Black poplar	M	850	23	16	Good	A		Retain	Yes
18498	Norway Maple	SM	350	15	12	Poor	B	Poor branching	Fell	Yes
18499	Norway Maple	SM	400	16	12	Poor	B		Fell	Yes
18500	Norway Maple	M	480	16	14	Fair	B		Fell	Yes
18501	Black poplar	M	700	22	12	Good	A		Retain	Yes
18502	Norway Maple	SM	350	16	12	Fair	B	Forked	Retain	Yes
18503	Norway Maple	SM	400	16	12	Good	A		Retain	Yes
18504	Black poplar	M	700	21	13	Good	A	Large Tree	Retain	Yes

DESCRIPTION OF WORKS

Map 3 Location of trees in relation to proposed development (Note: Trees up to 18491 only)

It is proposed to construct a fish bypass channel (map 1appendix)) around the existing weir on the north bank of the river Blackwater. These works would be carried out at the same time as weir reconstruction adjacent to the bypass channel.

The proposed works will encroach on amenity/recreation land and necessitate the removal of riverside trees and a parkland tree line.

DISCUSSION

The surveyed trees can be broadly divided into three phases of establishment:

1. Parkland planting, early 1800's.

2. Amenity planting 1980's.

3.Naturally regenerated trees, post 1900.

1 Parkland planting

Parkland planting, part of the Fermoy House landscaping dates from the early1800's. Nine trees along the river bank, all lime, date from this period. Six are on the proposed fish pass footprint- 51,52,56,57,60 and 74 and would need to be removed. Trees 51,51,56 and 60 are very large prominent trees and two – 57 and 74 are relatively low regrowth from the cut stumps of original trees.

Outside the proposed fish pass footprint three limes could be retained (69,70 and 71). However, 60 is regrowth from a cut stump and 70 is leaning over the river and would need to be cut back and allowed to coppice/regrow.

2. Amenity planting

Amenity planting during the 1980's along the river bank and on internal boundaries. Species planted are black poplar, Lombardy poplar, Norway maple, lime and Lawson's cypress.

The black poplar high trees and are prominent in landscape there are six individual trees 27,28,29,30 ,49 and 84 and one group, 61 that could be retained. The individual trees would need to be reduced in height to ensure their stability when neighbouring trees are felled. It should be noted that severed roots remaining on the site after excavation and construction will sucker and form dense regrowth.

There are three Lombardy poplars, 63,65 and 66 outside the proposed footprint however their height and form make them unsuitable for retention.

A total of eight Norway Maple are on the proposed footprint – 53,55,59,77,79,80,82 and 83. Only two of these trees are in good condition, the remaining six would not be suitable for long term retention anyway due to their poor branching structure and tendency for crown branches to collapse.

There are two semi-mature lime 54 and 58 on the proposed footprint, both would be suitable for long term retention.

The six Lawson's cypresses are growing amongst the black poplar and are suppressed. There are two dead trees. All are of low value and would be felled during development.

3. Naturally regenerated trees post 1900's.

Naturally regenerated trees have become established along the river bank since the1900's. They include alder, ash and sycamore all of which regenerate freely in damp fertile conditions.

Of particular value in the riparian habitats are alder, trees (50, 64,67 and 68) are multi-stemmed, and several are decaying. They are outside the fish pass footprint, are important for biodiversity and should be retained if possible.

Elm is present in the understorey, probably regrowth from mature trees lost to the endemic elm disease in the 1980's.

SUMMARY AND RECOMMENDATIONS (Table 4)

To conclude the loss of the 1980's planted trees, poplar, Norway maple, lime and Lawson's cypress will impact negatively on the landscape, but they are easily replaced by replanting with similar species in the medium term and 10 trees in the immediate vicinity of the development can be retained.

Trees within the riparian zone, particularly the 4 mature alder should be retained if at all possible alongside the proposed fishpass. Alder will coppice from cut stumps if trees need to be cut back.

The mature limes planted in 1800 are a prominent landscape feature and have cultural interest, 6 of the 9 trees would need to be removed. Their loss would be substantial and negative.

ARBORICULTURAL METHOD STATEMENT

Tree surgery works.

All works should be carried out to BS 3998(2010) Tree Work-Recommendations for professional tree surgeons.

Table 4 : Trees outside the proposed development footprint which may be retained subject to construction access and working areas.

Tree no.	Species	Stem diameter (mm)	RPA (m)	Recommendations and Comments	
18427	Black Poplar	700	8.4	Retain	Reduce height 50%
18428	Black Poplar	500	6.0	Retain	
18429	Black Poplar	550	6.6	Retain	
18430	Black poplar	500	6.0	Retain	
18449	Black Poplar	500	6.0	Retain	
18450	Alder	200 x 5	3.0	Multi-stemmed. (Over weir, cut back)	
18461	Black Poplar	180	2.2	Retain, group	
18463	Lombardy Poplar	380	4.5	Fell	
18464	Alder	550	6.6	Retain	
18465	Lombardy poplar	350	4.2	Fell	
18466	Lombardy poplar	350	4.2	Fell	
18467	Alder	650	7.8	Retain, (over river)	
18468	Alder	500	6.0	Retain,(over river)	
18469	Lime	200	7.2	Retain, (regrowth from 600mm diameter stump).	
18470	Lime	900	10.8	Retain	
18471	Lime	900	10.8	Retain, (over river , cut back)	
18484	Black poplar	750	9.0	Retain, (reduce crown by 30%)	
18485	Norway maple	480	5.7	Retain	

APPENDIX 1: TREE PROTECTION

Root Protection Area (R.P.A) and Tree Protection Measures

The Root Protection Area is defined as a layout design tool indicating the minimum area, usually defined as the radius in metres, around a tree deemed to contain sufficient roots to maintain the trees viability. Protection of roots within the RPA is treated as a priority. When considering the consequences of development and construction activity in the vicinity of trees the R.P.A. which is calculated from the girth of the individual tree (12 x the girth at 1.5 metres above ground for a single stemmed tree) must be protected. The default position is that all structures must be located outside the R.P.A., however each tree should be assessed on a case by case basis and different trees species vary in their susceptibility to root disturbance. The R.P.A. for each tree retained on site needs to be protected by barriers before any materials or machines are brought on site, and before any demolition activity or stripping of top soil. British Standard Specifications are outlined in (Fig.1), below.

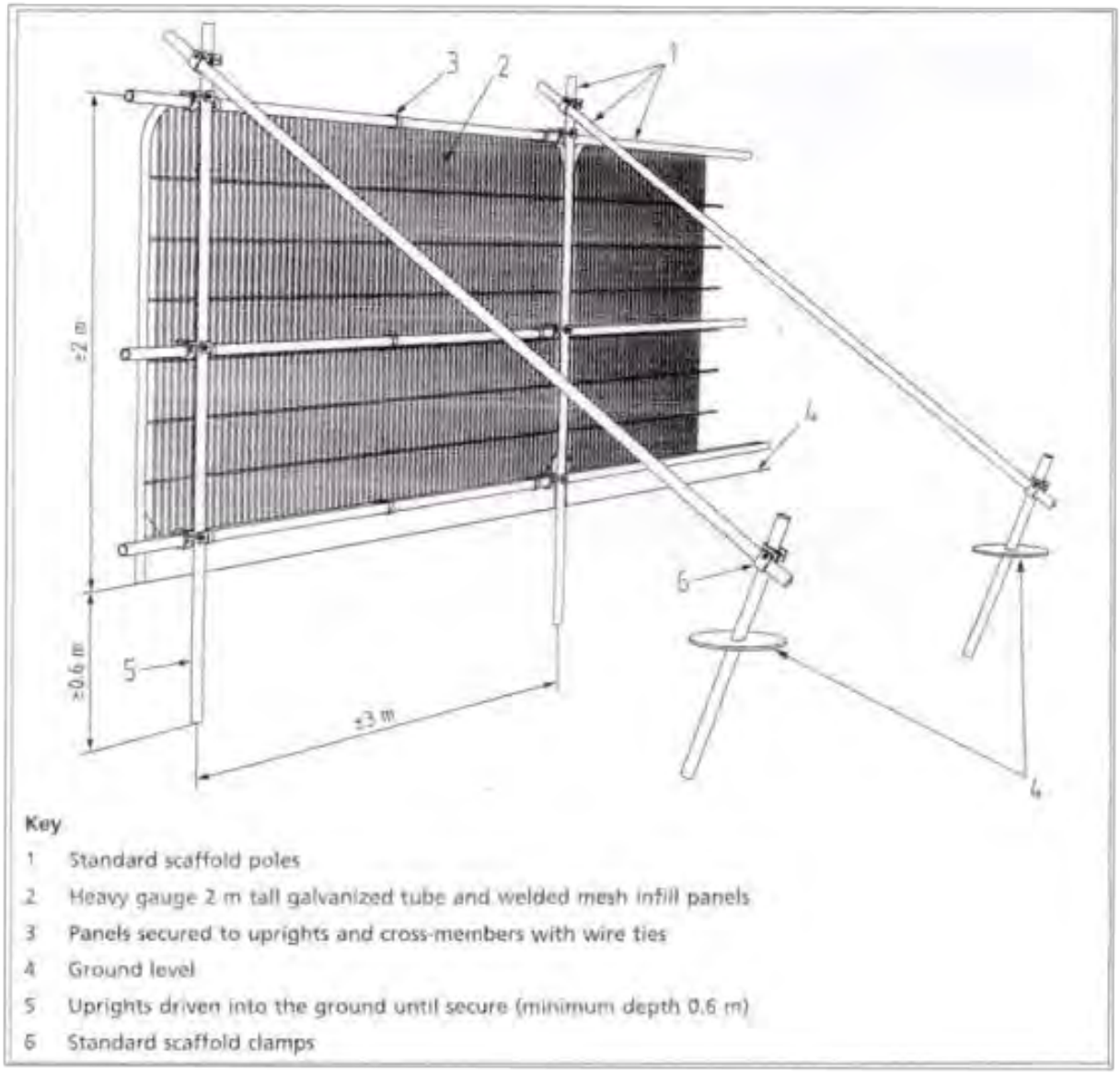


Fig.1 Default Specification for Protective Barrier

The area protected by barriers must be regarded as sacrosanct and the barriers must be fit for purpose. Where required, pre-construction tree work including crown reduction and thinning works should be carried out before protection measures are installed.
Where there is no alternative and construction work space or temporary access is justified within the R.P.A. new temporary ground protection should be installed as part of the implementation of physical tree protection measures prior to work starting on site. The objective is to avoid any compaction of soil within the R.P.A., even from the single passage of a heavy vehicle, especially in wet conditions so that tree root functions remain unimpaired.

Permanent Hard Surfacing within the R.P.A.

Within the R.P.A. unavoidable permanent hard surfacing should not exceed 20% of the area. Where necessary, works will be designed to avoid localised compaction and where a permeable surface is to be used by vehicular traffic, for example a geotextile can be used

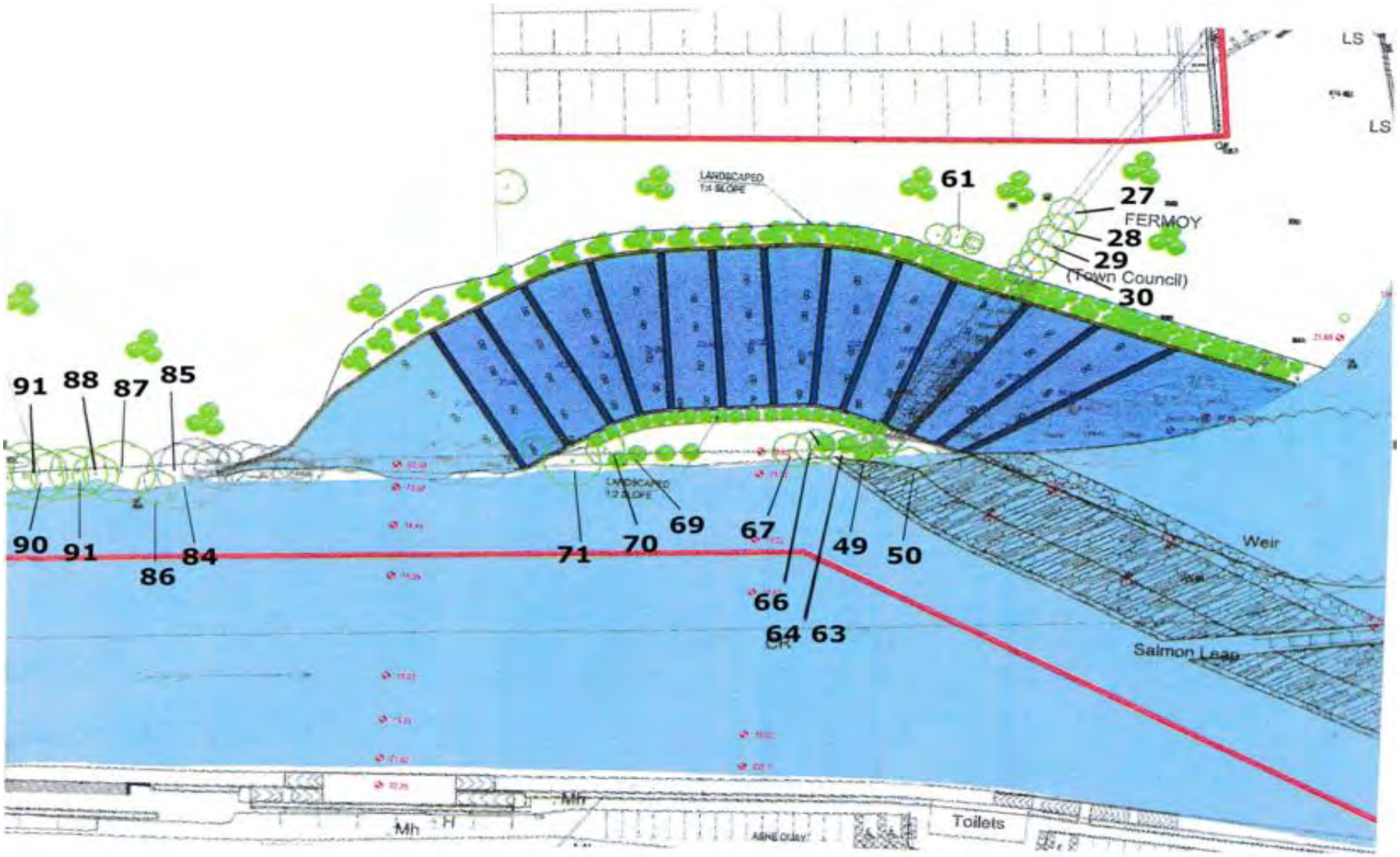
Excavation within the R.P.A.

Excavation needed for placement of kerbs and edgings with linear foundations can be especially damaging to tree roots within the R.P.A .and should be avoided either by the use of alternative edge supports or by not using supports at all.
The use of traditional strip footings for buildings within the RPA can result in extensive root loss and should also be avoided. Root damage can be minimised and mitigated against by ensuring beams and slabs are laid over roots at or above ground level and do not exceed a total area greater than 20% of the existing unsurfaced ground within the R.P.A. There should be no changes in ground levels within the R.P.A.

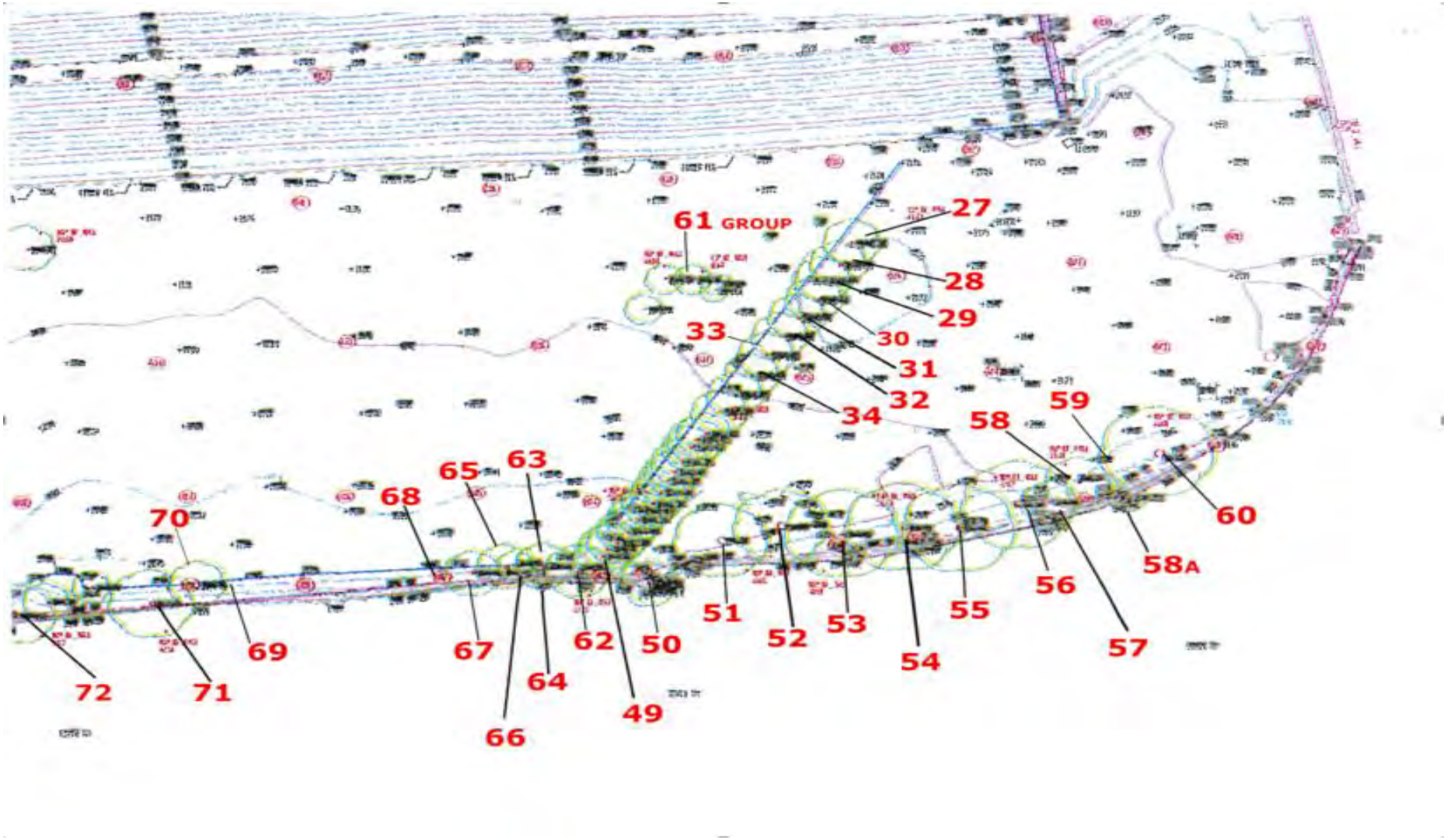
Additional Precautions outside the R.P.A. exclusion zone

Planning of site operations needs to take account of machinery/plant, particularly machines with booms and jibs, from coming into contact with above ground branches etc of retained trees. Also any materials whose accidental spillage would cause damage to a tree should be stored and handled well away from the outer edge of its R.P.A.

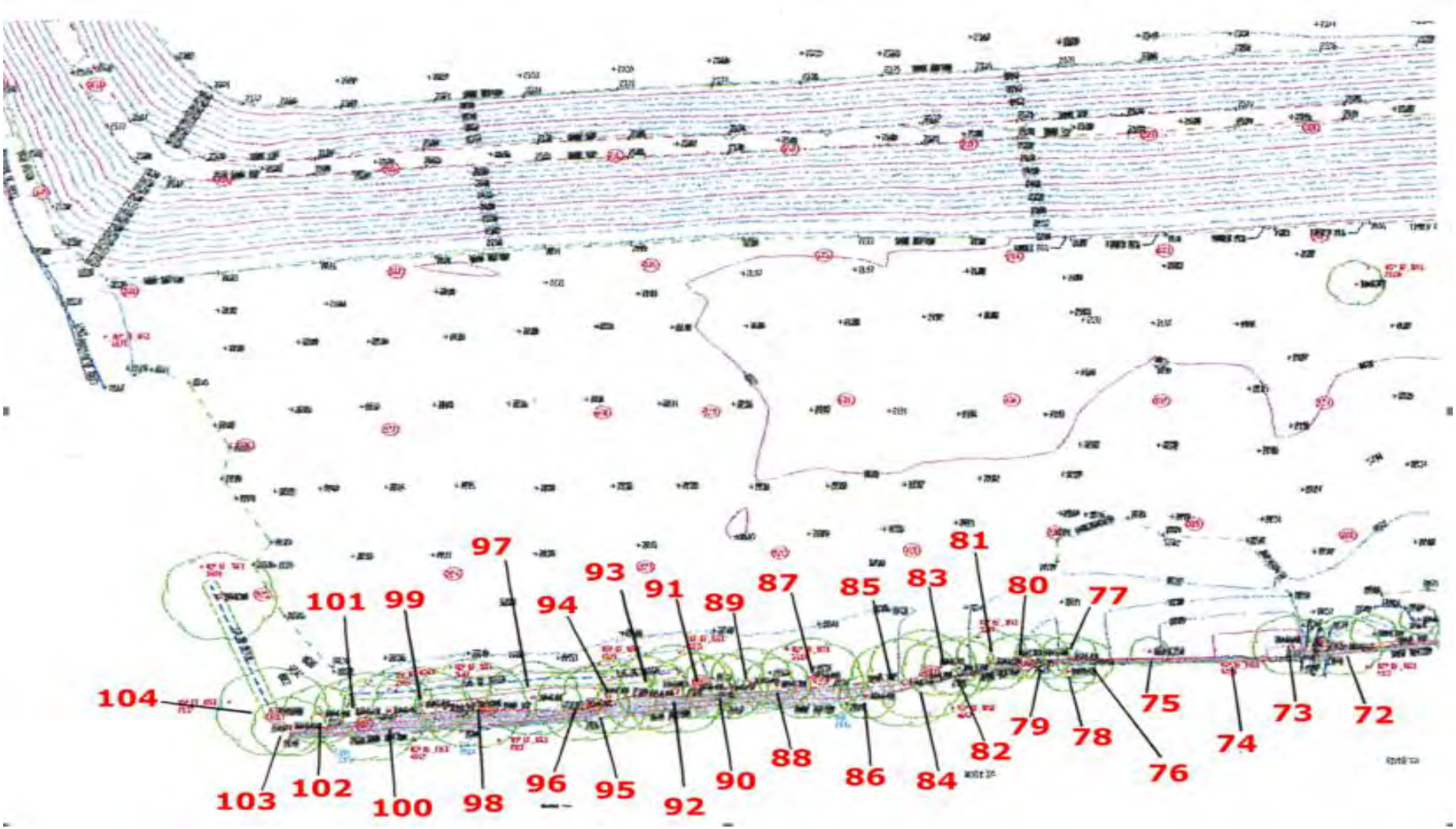
APPENDIX2 : MAP 1 Trees outside footprint of proposed fish Bypass



APPENDIX 3: MAP 2 Locations of individual trees (Eastern area)



APPENDIX 4: MAP 3 Locations of individual trees (Western area)



Appendix 5. Invasive Species Management Plan

DixonBrosnan
environmental consultants

Outline Invasive Species Management Plan (ISMP)

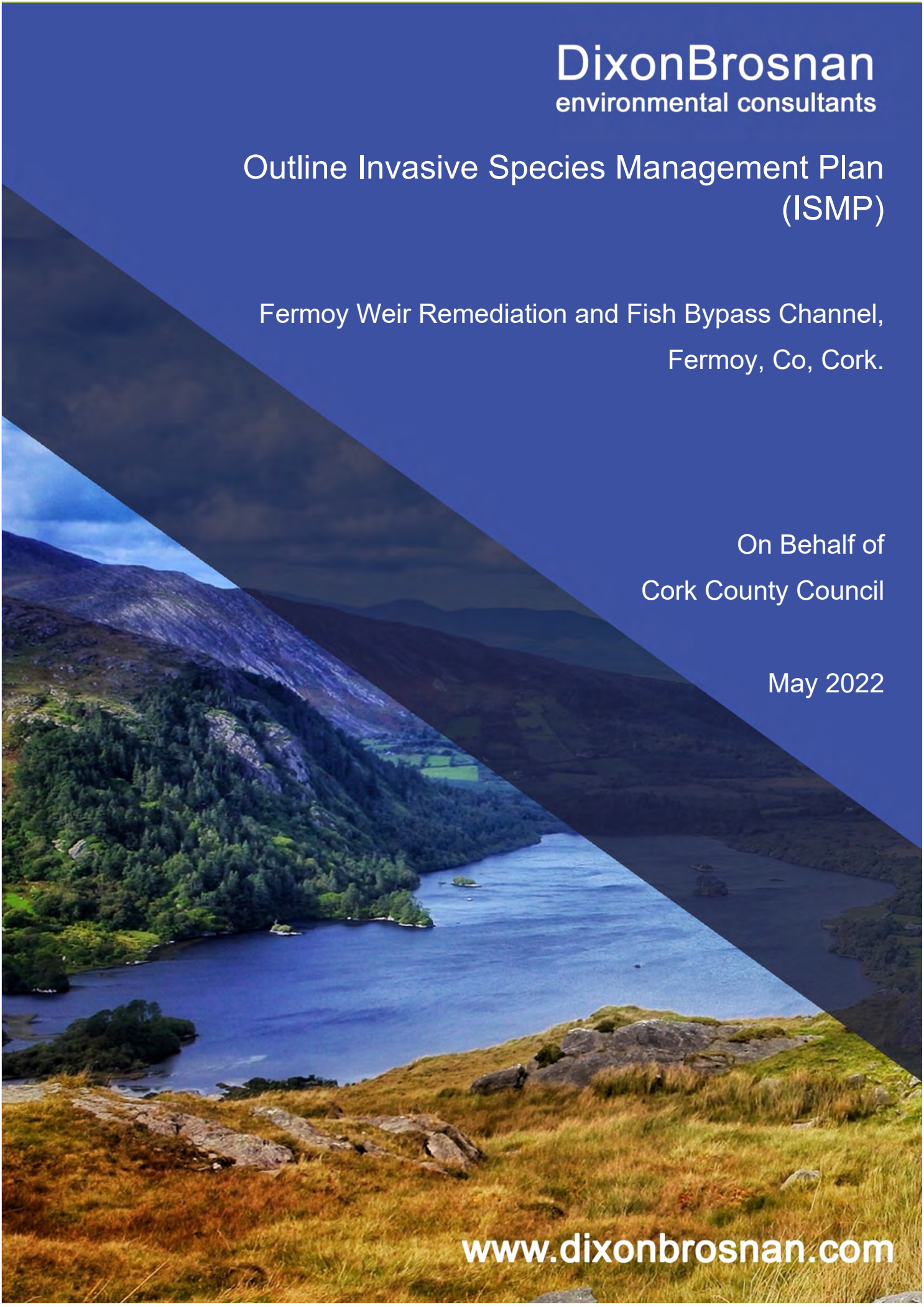
Fermoy Weir Remediation and Fish Bypass Channel,

Fermoy, Co, Cork.

On Behalf of

Cork County Council

May 2022



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environmental consultants

Project	Outline Invasive Species Management Plan (ISMP) Fermoy Weir Remediation and Fish Bypass Channel, Fermoy, Co, Cork	
Client	Cork County Council	
Project Ref.	2091	
Report No.	2091.03	
Client Ref.	-	
Date	**Revision**	**Prepared By**
29/04/22	First Draft	Carl Dixon BSc MSc
27/05/22	Issue to Client	Cian Gill MSc

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Table of Contents

1. Introduction

DixonBrosnan were commissioned to survey for invasive species at the proposed Fermoy Weir Remediation and Fish Bypass Channel works, Fermoy Co. Cork.

This report was prepared by Carl Dixon MSc (Ecological Monitoring) and Cian Gill MSc (Ecological Monitoring).

Carl Dixon MSc (Ecology) is a senior ecologist who has over 20 years' experience in ecological and water quality assessments. Carl Dixon holds an Honours Degree (BSc) in Ecology and a Masters (MSc) in Ecological Monitoring from UCC. He is a senior ecologist who has over 25 years' experience in ecological assessment. Prior to setting up DixonBrosnan Environmental Consultants in 2000, Carl set up and ran Core Environmental Services which included Rural Environmental Protection Scheme (REPS) planning for landowners and ecological assessments. Carl has particular experience in freshwater ecology including electrofishing fish stock assessments and water quality assessments. He also has considerable experience in habitat mapping and mammal ecology including survey work and reporting in relation to badgers and bats. Other competencies include surveys for invasive species and bird surveys. Carl has extensive experience with regards to EIAR and NIS mitigation and impact assessment. He has particular experience in large-scale industrial developments with extensive experience in complex assessments as part of multi-disciplinary teams. Such projects include gas pipelines, incinerators, electrical cable routes, oil refineries and quarries.

Cian Gill MSc (Ecology) is a qualified ecologist with ten years' experience working with wildlife and ecology-based NGOs and public bodies in Ireland, the UK and the US. Past projects include invasive species planning for the city of Rosemount, Minnesota, and the Under The Sea project for Essex Wildlife Trust. Recent projects include ecological reports for Cork-based housing and private developments.

2. Invasive species

2.1 Desktop Review

Non-native plants are defined as those plants which have been introduced outside of their native range by humans and their activities, either purposefully or accidentally. Invasive non-native species are so-called as they typically display one or more of the following characteristics or features: (1) prolific reproduction through seed dispersal and/or re-growth from plant fragments; (2) rapid growth patterns; and, (3) resistance to standard weed control methods.

Where a non-native species displays invasive qualities and is not managed it can potentially: (1) out compete native vegetation, affecting plant community structure and habitat for wildlife; (2) cause damage to infrastructure including road carriageways, footpaths, walls and foundations; and, (3) have an adverse effect on landscape quality. The NBDC lists a number of both aquatic and terrestrial high impact invasive species which have been recorded within grid square W89 (**Table 1**).

Table 1. High impact invasive flowering plant species recorded in W89

Species group	Species name
flowering plant	Canadian Waterweed (*Elodea canadensis*)
flowering plant	Cherry Laurel (*Prunus laurocerasus*)
flowering plant	Giant Hogweed (*Heracleum mantegazzianum*)
flowering plant	Indian Balsam (*Impatiens glandulifera*)
flowering plant	Japanese Knotweed (*Fallopia japonica*)
flowering plant	*Rhododendron ponticum*

Source NBDC: 28/10/21

The control of invasive species in Ireland comes under the Wildlife (Amendment) Act 2000, where it states that

'Any person who— [...] plants or otherwise causes to grow in a wild state in any place in the State any species of flora, or the flowers, roots, seeds or spores of flora, ['refers only to exotic species thereof'][...] otherwise than under and in accordance with a licence granted in that behalf by the Minister shall be guilty of an offence.'

The Birds and Natural Habitats Regulations 2011 (SI 477 of 2011), Section 49(2) prohibits the introduction and dispersal of species listed in the Third Schedule, which includes Rhododendron *Rhododendron ponticum* and Japanese Knotweed *Fallopia japonica*, as follows: *"any person who plants, disperses, allows or causes to disperse, spreads or otherwise causes to grow [….] shall be guilty of an offence."*

2.2 Site Survey

Two Third Schedule invasive species were recorded within the proposed development site. Himalayan Balsam both juvenile and adult plants, is widely scattered throughout the riparian zone. One area of Japanese Knotweed was recorded on the southern banks of the proposed development site (**Figure 1**). No other invasive floral species were recorded.

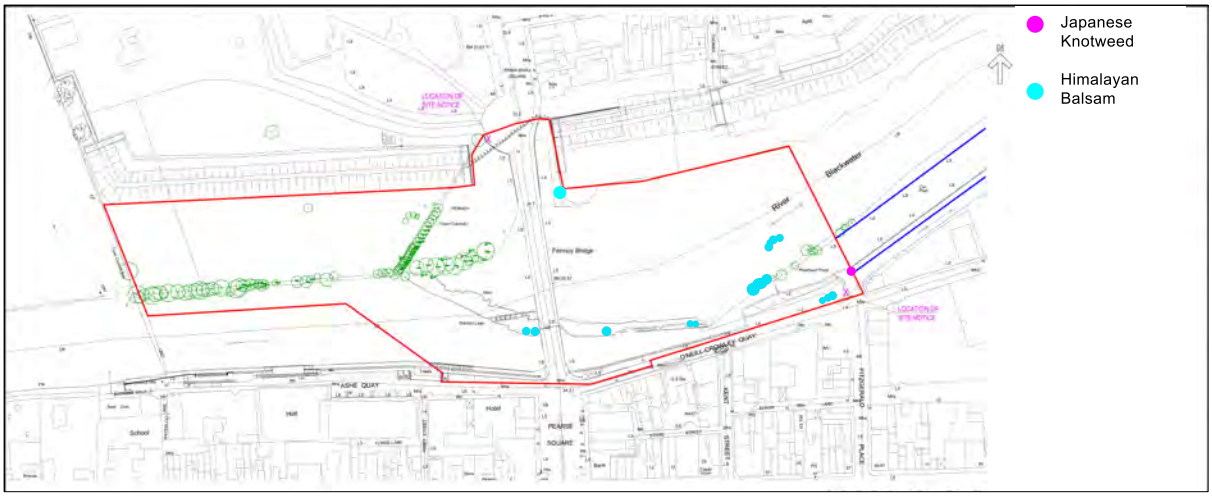

Figure 1. Location of invasive species proposed development site

2.3 Japanese Knotweed

Japanese Knotweed is a highly invasive, non-native species which was originally introduced as an ornamental plant but has since spread along transport routes and rivers to become a serious problem. This species can grow up to 2-3 m in height and can dominate an area to the exclusion of most other plants (**Figure 2**). It can form an extensive network of rhizomes (roots) which cause problems when managing this species. The rhizomes also allow the plant to survive over winter when the over ground conspicuous leafy part of the plant dies back to a brown wasted stem.

Japanese Knotweed spreads rapidly in the wild by natural means or by humans. Spread is solely by vegetative means, either fragments of rhizome or stem. Negative impacts include outcompeting native flora, contributing to river bank erosion and increasing the likelihood of flooding. This plant has the ability to grow through tarmac and concrete, although only if a weakness already exists and therefore must be cleared completely before starting to build or lay roads.

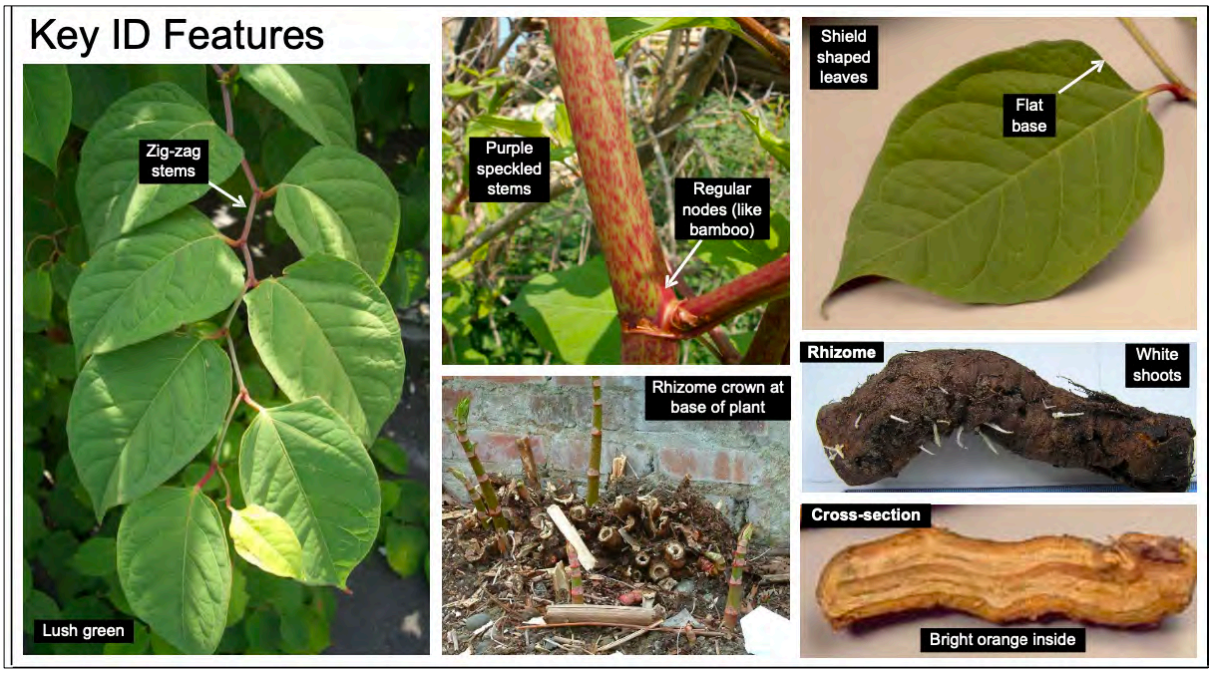

Figure 2. Characteristics of Japanese Knotweed

2.4 Himalayan Balsam

Himalayan Balsam is an invasive terrestrial plant species that was first introduced in the Ireland in 1800's as an ornamental garden plant. Since it was introduced, it has spread to most parts of Ireland. Due to the nutrient poor soil and cold temperatures in its home range, the Himalayas, it has adapted to develop thousands of seeds, which are dispersed widely as the ripe seedpods shoot their seeds up to 7m (22ft) away. Due to our warmer climate and nutrient rich soils, it has thrived here and became highly invasive. Once established in the catchment of a river the seeds, which can remain viable for two years, are transported further afield by water.

Himalayan Balsam is a tall, attractive, annual herb with explosive seed heads (**Figure 3**). Although easy to identify as a mature plant with its pink-purple flowers, fleshy stem and

characteristic leaves, the seedlings and last year's dead stems of this perennial are more difficult to spot. Spreads solely by seeds, which are small and easily carried by wind or water. This species out-competes native species in ecologically sensitive areas, particularly riverbanks. Where it grows in dense stands along riverbanks it can impede flow at times of high rainfall, increasing the likelihood of flooding. Die back of extensive stands over winter can leave riverbanks bare and exposed to erosion.

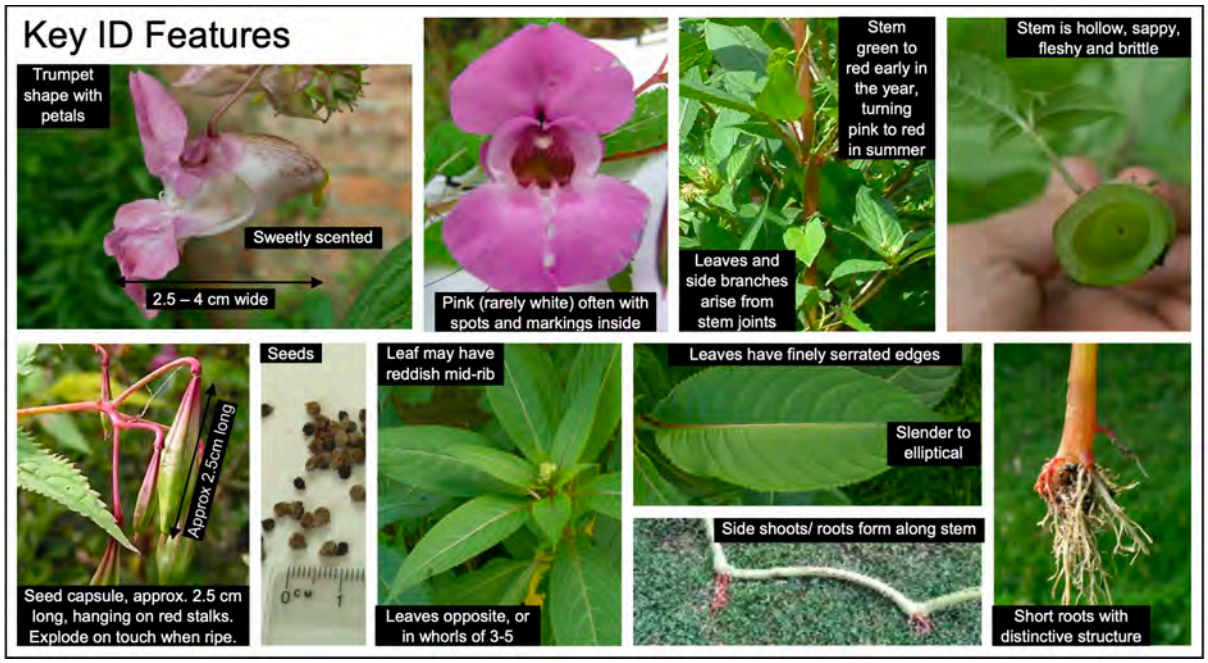

Figure 3. Characteristics of Himalayan Balsam

3. Japanese Knotweed Management During Construction Phase

This purpose of this plan is to:

- Identify the extent of the infestation on the site
- Ensure further growth and spread of the plant on the site does not occur
- Ensure the plant is not spread to other sites either adjacent to the infested site or through transportation of contaminated soil to another site
- Identify the best method for managing and controlling Japanese Knotweed and other invasive species on the site with regard to the proposed site works and construction methods
- Communicate the plan to all site operatives to ensure success of the plan
- Document and record the treatment and management methods carried out on site for future reference, for future site owners and site users and to avoid litigation.

The contractor will employ a suitably qualified ecologist to update the plan prior to the commencement of construction. The updated plan will contain the following:

- Site background including proposed works

- Extent of the Japanese Knotweed infestation
- Specific control plan to be put in place
- Site hygiene protocols
- Responsible individuals
- Follow up requirements
- Any other relevant information

3.1 Management Options for Knotweed Species

There are a number of suitable management options to control and prevent the spread of Japanese Knotweed. The methodology outlined in this document will be updated, if required, based on an up to date survey of the contaminated area. The proposed management plan will be agreed with Cork City Council prior to the works being carried out. It should be noted that:

- Where any infested material (soil containing Japanese Knotweed is to be taken off site, a licence to transport the material will be required from National Parks and Wildlife Service (NPWS).
- A landfill, which is licensed to accept such material, will be identified to dispose of the excavated material. The landfill site operator will be informed of what the material contains.
- Where herbicide treatment will be used, consideration will be given to the proximity of the herbicide treatment to other vegetation/habitats.

For all management plans, site hygiene protocols will be implemented. These protocols will apply to sites which are infested with Knotweed and those where Knotweed is not growing to prevent contaminated material being brought to site. Site hygiene protocols are outlined in **Section 3.3** below.

3.2 Pre-Construction Survey

Since invasive species spread quickly, prior to the commencement of treatment, a pre-construction survey will be undertaken to identify the extent of invasive species at that time. The survey will be undertaken by a suitably qualified ecologist. This information will be utilised to update the ISMP.

3.3 Site Hygiene at Contaminated Area

Construction equipment, vehicles and footwear may provide a vector for the spread of invasive species. Maintaining site hygiene at all times in an area affected by invasive species is essential to prevent further spread.

The following site hygiene measures will be implemented for the contaminated area:

- Understand the potential extent of the rhizome (root) system underground – up to seven metres horizontally and three metres vertically.
- Where possible, the contaminated area will be avoided and fenced off, or the extent of the rhizomes clearly marked.
- If possible, the use of machinery with tracks will be avoid contaminated areas. Movement of machinery between contaminated and non-contaminated areas must be controlled and adequate power washing measures implemented.
- Areas where contaminated soil is to be stockpiled on site will be clearly identified and marked out.
- Designated entry and exit points will be identified for personnel on foot and for small mobile equipment. A delineated access track, to be maintained free of Japanese Knotweed, will be established through the site to minimise the spread of Knotweed species by permitted vehicles accessing the site.
- Vehicles, including footwear and tools, leaving the site will be inspected for any plant material and washed down (using a pressure washer) in a dedicated vehicular wheel wash down facility, which will drain into a contained area within the site. Particular care is required with tracked machines.
- Vehicles used in the transport of contaminated material will be visually checked and washed down into a contained area before being used for any other work, either in the same area or on a different site.
- Only vehicles required for essential works including site investigation works will be brought on site and the number of visits minimised as much as practicable.
- Material gathered in the dedicated wash down contained areas will be appropriately disposed of off-site.
- For any subsoil or topsoil entering the site, the supplier will be required to provide an assurance that it is free of Japanese Knotweed.
- All site personnel will be made aware of measures to be taken and will be informed of the requirements of the ISMP.
- Site hygiene signage, in relation to the management of invasive species, will be erected.

3.4 Management Options

In addition to the possible advance treatment works and pre-construction survey, when the works areas become available to the contractor for enabling works, areas identified as requiring specific invasive species treatment will be demarcated and the designated control measures implemented at the earliest possible stage to reduce the risk of spread along the proposed scheme or beyond the land take.

There are a number of management options that may be implemented to control and prevent the spread of invasive species. These are presented in the sections below.

Those involved in the application of herbicides/pesticides will be competent to do so and, consequently, will have sufficient training, experience and knowledge in the area of herbicides/pesticides application.

All staff involved in the application of herbicides/pesticides will have received appropriate training, which may include achieving competency certification in the safe use of herbicides/pesticides through a National Proficiency Tests Council registered assessment centre or achieving an appropriate FETAC award in this area.

It is likely that chemical treatment, as described in **Section 3.5** will be the most suitable method for the identified invasive species.

3.5 Chemical Treatment

The control of Japanese Knotweed will require the use of herbicides, which can pose a risk to human health, to non-target plants or to wildlife. In order to ensure the safety of herbicide applicators and of other public users of the site, it is essential that a competent and qualified person carries out the herbicide treatment. A qualified and experienced contractor will be employed to carry out all treatment work.

The contractor will follow the detailed recommendations of the following documents for the control of invasive species and noxious weeds:

Chapter 7 and Appendix 3 of the TII Publication: The Management of Noxious Weeds and Non-Native Invasive Plant Species on National Roads (NRA, 2010)

Best Practice Management Guidelines for Japanese Knotweed (Invasive Species Ireland, 2015)

Circular Letter NPWS 2/08 Use of Herbicide Spray on Vegetated Road Verges (National Parks and Wildlife Service 2008)

These documents include measures to aid the identification of relevant species, with details for the timing, chemicals and methodology for chemical control, and for measures to avoid environmental damage during the use of herbicides.

Chemical treatment involves the application of an herbicide to invasive species plant such as Japanese Knotweed stands without any excavation or removal of the plant material. The preferred types of herbicides to be used in the treatment of Knotweed are Glyphosate and 2,4-D Amine.

If herbicide is applied as the treatment option, it may need to be reapplied for up to five years after the first application to ensure the plant control measures have been effective.

Glyphosate is non-persistent and can be used near water but it is not selective (i.e. it is a broad spectrum chemical and will impact all plant species) whereas 2,4-D Amine can be persistent for up to one month, and can also be used near water but is more selective on certain plants. The selection of chemical by the contractor and supervising ecologist will depend on seasonal factors, site conditions, proximity to water, surrounding habitats etc.

The most effective time to apply Glyphosate is from July to September (or before cold weather causes leaves to discolour and fall). The majority of herbicides are not effective during the winter dormant stage because they require living foliage to take up the active ingredient.

Reapplication rates will depend on site specific considerations including the extent of the infestation, its location, and the time of year treatment commences. Details of the proposed chemical treatment plan will be included in the updated ISMP based the proposed work programme.

Foliar treatment (spraying) is usually applied with a sprayer such as a knapsack sprayer or a larger spray system. It is important to use a treatment dye to identify clearly all areas treated. Foliar treatment is an efficient way to treat large monocultures of invasive plants, or to spot-treat individual plants that are difficult to remove mechanically such as Japanese Knotweed.

In the case of Knotweed, depending on weather and temperatures in the days following the initial treatment, and to ensure optimal uptake of herbicide into the rhizome system, a second similar treatment will be required usually within ten days, before the internal vascular system is no longer capable of translocating the herbicide to the root system.

While the upper surface of the leaves will be easier to treat, it is also important to treat the leaf under surface as Knotweed possesses many stomata openings on the leaf under surface. Dead stems can be cut, removed and burned on/off site in accordance with the relevant legislation.

The stem injection method is sometimes used for Japanese Knotweed control. This treatment requires a higher concentration of the active ingredient than is used in foliar applications. It involves the use of a specialist herbicide injection tool whereby the injection tool injects the herbicide directly into each of the canes approximately 20-30cms from the base of each cane (between the 1st and 2nd nodule).

Subsequently approximately 10 mL of herbicide mix is injected into each cane at a ratio of 5:1 through the use of a specialist stem injection tool. The application of glyphosate-based products by injection is most effective when applied in the early Autumn (mid to late Sept). Regrowth will occur in subsequent years, albeit much less vigorously, which will require follow up treatment at the appropriate time of year. Spot treatment will be required each year until no regrowth is observed.

In order to ensure that the use of herbicides does not contravene legislation, the contractor must comply with Circular Letter NPWS 2/08 *Use of Herbicide Spray on Vegetated Road Verges* from the National Parks and Wildlife Service dealing with the application on to non-target areas.

3.6 Excavation and Chemical Treatment On-Site

This option employs both physical and chemical methods of treatment. This method is employed in situations where treatment of invasive species, in particular Knotweed, is required to be completed in a relatively short timeframe. Generally, digging up the rhizomes and re-cultivating it stimulates plant growth and will result in more successful herbicide application and management.

In summary, this management method requires cutting and killing of the surface plant. The cut material must be left on top of plastic sheeting until dried out and subsequently monitored for any sign of regrowth. Storage of cut material should not take place within flood risk zone of a river. The cut material should not be placed in a green waste recycling bin. Once dried out, the material should be burned on site in accordance with the relevant legislation. The surface of the affected area should be raked with tines to remove crowns and surface material, and in order to break up the rhizomes, bringing them to the surface, which will stimulate leaf production. This will make the plant more vulnerable to herbicide treatment. The more rhizomes that are brought to the surface, the more growth will occur, allowing for a more successful treatment. An excavator can be used to scrape the surface crowns and rhizomes into a pile and then to cultivate the ground to stimulate rhizomes to produce a higher density of stems for treatment. Reapplication of herbicide may be required for up to five years after initially application, subject to the site-specific management plan.

3.7 Excavation and burial

Excavated material containing Knotweed can also be buried on site. This will require burying the material at a depth of at least five metres. The contaminated material must be covered with a root barrier membrane before being backfilled with topsoil, or other, suitable fill material. The manufacturer's guarantee is required that the membrane will stay intact for at least 50 years. An accurate map and record of the location of the burial site, to prevent any future accidental disturbance, is required, and future owners must be informed of its position. If soil containing Japanese Knotweed is stockpiled, the material must be stored in a manner that will not harm health or the environment. The stockpile should be on an area of the site that will remain undisturbed. The area should be clearly fenced and marked with warning signs, and the stockpile should be regularly treated with herbicide to prevent any regrowth or re-infestation.

As a precaution, the stockpiled material should be laid on a root barrier membrane and covered to avoid contaminating the site further. The contractor must also comply with all waste legislation.

3.8 Excavation and root barrier cell method

Excavated material containing Knotweed can also be buried on site within a root barrier membrane cell. The procedure is similar to that described in **Section 3.7** above.

This method will require burying the material at a depth of at least two metres. The contaminated material must be placed in a contained cell formed by a root barrier membrane before being backfilled with topsoil, or other, suitable fill material. The manufacturer's guarantee is required that the membrane will stay intact for at least 50 years. The method for stockpiling prior to burial would be as described as above. The contractor must also comply with all waste legislation.

3.9 Excavation and bund method

Where there is not sufficient depth on a site excavated material can be placed in a structured bund. The bund will comprise a raised area above ground level or a shallow excavation, no more than 0.5m deep, and lined with a root barrier membrane. The manufacturer's guarantee is required that the membrane will stay intact for at least 50 years. This method of treatment

can also be used where Knotweed material needs to be moved from a location and there is another area of the site available to contain it.

The aim of this method is to concentrate the rhizome material into the upper surface of the bund, where it will grow and be controlled by herbicide. If the rhizome is buried deep, it will become dormant when inside the bund and regrow when the apparently clean soil is used for landscaping on the site. The bund location needs to be clearly marked by warning signs and protected from potential accidental damage. Reapplication of herbicide may be required for up to five years after the initial application, subject to the site-specific management plan.

The appointed contractor must comply with waste legislation if this method is to be considered.

3.10 Excavation and removal from site

Where the above treatment options are not possible because the site is too small to contain excavated material, or too shallow for burial, or where there is a lack of space or where the infestation simply cannot be avoided by the construction works, removal of excavated material may be the only option. If any invasive species plant material is collected (e.g. by hand-pulling or mowing), it is important that its disposal will not lead to a risk of further spread. Where there are small amounts of Knotweed material to be removed it is possible to double bag the material and send to a licenced waste facility for disposal. Where the amount of material is larger in volume, it will be necessary to haul it from site to a suitably licenced waste facility.

Invasive species material, particularly roots, flower heads or seeds, must be disposed of at licensed waste facilities appropriately buried, or incinerated in compliance with the relevant legislation. Disposal must be carried out in accordance with the relevant waste management legislation. Invasive species plant material or soil containing residual herbicides may be classified as either ‘hazardous waste’ or ‘non-hazardous waste’ under the terms of the Waste Management Acts, and both categories may require special disposal procedures or permissions. If the material has been treated with a persistent herbicide, the excavated material must be classified as hazardous waste and must be disposed of to a hazardous waste facility. Advice would need to be sought from a suitably qualified waste expert regarding the classification of the waste and the suitability of different disposal measures.

The movement of invasive plant material requires a licence from the NPWS under Section 49 of the European Communities (Birds and Natural Habitats) Regulations, 2011 (as amended).

3.11 Preferred Treatment Option

The Knotweed within the proposed development boundary is located on existing flood defence structures. As there is the potential for flooding to impact on the area currently contaminated with Knotweed species, there is the potential for fragments of Knotweed to be spread from the works area and inadvertently distributed off-site.

Having assessed the available management options and constraints associated with this particular site, it has been concluded that in-situ chemical treatment prior to construction, careful management of the works and continued in-situ chemical treatment post construction is the preferred option. This is primarily due to the following significant constraints;

- The Knotweed contamination adjoining the Mill Race is located on an existing flood defence structure and although limited works within this area will occur, it is preferable

to avoid large scale excavation and removal of Knotweed contaminated material which could damage the existing flood defence structure and increase the risk of flooding to the site.

- The risk of fragments of Knotweed being spread outside of its current distribution is high as high flood levels could result in fragments of Knotweed, which are dislodged during site works, being carried downstream along the River Blackwater and thus impacts on off-site receptors could occur.

- Given that flooding could impact on existing stands of Knotweed, large scale foliar spraying is not recommended and therefore only stem injection and spot treatment is practical as a first treatment method. For the re-growth material within the site or juvenile plants, a foliar spray application using a cowled knapsack sprayer will allow for efficient treatment when stems are too small and fragile to use stem injection.

Therefore, the following methodology is proposed:

1. Contractor will commence chemical treatment of the Knotweed species in this area, in order to avoid the continued spread of the species. The preferred method for initial treatment is stem injection and spot treatment. This will be carried out under the supervision of a qualified ecologist who will ensure that the correct methodology and appropriate site hygiene methods are utilised. This ISMP will be updated by the supervising ecologist if required. Early treatment will effectively reduce the length of time that chemical treatment will be required. It is noted that Knotweed can persist for long periods and the sooner treatment commences, the more rapidly this species will be eradicated from the works area.

2. Prior to the commencement of site works, the extent of contamination will be determined by site investigations including trial pits. This information will be used to determine the area of contamination taking into account that the roots of Knotweed can extend 7m from the parent plant. If it is determined by visual inspections/trial hole investigation that viable plants remain within the work area the spreading of this viable Knotweed plant material outside the current area of contamination is not permitted.

3. Following the above, the identified area of contamination will be clearly fenced and all works in relation to Knotweed will be carried out only within this fenced area.

4. Where possible, contaminated soil will remain on-site and be treated. The transport of any material that must be removed off site for disposal, as part of the construction works, will require a licence from the NPWS.

5. Any excavations that are carried out as part of the project, must be contained within this area and the spread of any fragments of viable plant material or contaminated soil outside of this area must be effectively prevented. All hygiene protocols as listed in this ISMP must be effectively implemented.

6. Any contaminated material including material from the wash down area must be contained within the identified and fenced contaminated area or removed to a suitably licenced facility offsite in line with standard hygiene measures.

7. Once works within the contaminated area is complete a follow-up programme of works will commence to treat any regrowth of Knotweed. This will consist of stem injection and spot treatment and it will continue until the supervising ecologist can certify that Knotweed has been effectively eradicated.

8. The application of herbicide (injection/spot treatment) must take into account the risk of flooding which must be assessed immediately prior to the use of herbicides. Treatment will not be carried out when heavy rain is forecast or in the winter period when there is a higher risk of flooding and adverse weather. It is noted that site hygiene is of particular importance in areas prone to flooding.

The treatment programme will be carried out by a suitably qualified person who has experience of treating invasive species and will be carried out in line with the herbicide manufacturer's instructions. A five-year monitoring programme will be put in place to ensure that the herbicide has been successful

4. Himalayan Balsam Management During Construction

Any Himalayan Balsam within the works will be hand-pulled and bagged prior to the commencement or site works. It will be then placed in a designated area of the site to decay. The seeds are not particularly robust but may survive for 18 months so a two-year programme of control, which will extend beyond the construction period, will be required. All machinery leaving the site will be washed down in a designated wash down area in proximity to the site exit to prevent seeds from being spread outside the site boundary.

If and where contaminated soil or heaps of high-risk invasive species (i.e. Himalayan Balsam) are to be stockpiled, the area will be clearly marked out on site. These areas will not be within 50m of any watercourse or flood zone.

5. Conclusions

Two high risk invasive species were recorded within the proposed development site i.e., Japanese Knotweed and Himalayan Balsam.

Japanese Knotweed is a high risk invasive plant species and will be treated in accordance with this ISMP. The primary concern is the presence of Knotweed species within the flood embankment area where works are proposed. Herbicide treatment of Knotweed via stem injection and spot treatment will commence as soon as practically possible under the supervision of a qualified ecologist. Site investigations will be carried out prior to the commencement of works to determine if Knotweed species are still present and the degree of contamination.

This information will be utilised to determine the extent of the contaminated area and will be utilised to update this ISMP. Detailed fencing and hygiene protocols will ensure that viable plant material will not be spread outside of its current distribution area. Following completion of works, monitoring and treatment protocols will be implemented to ensure any regrowth is effectively treated.

No impediment to the removal of these species within the study area, as part of a detailed invasive species management plan, have been identified.

This outline ISMP will be updated by the supervising ecologist based on up-to-date survey data, prior to the commencement of proposed development.

Appendix 6. Drawings

N

LEGEND:

PLANNING RED LINE BOUNDARY

PERMANENT WAYLEAVES

SITE NOTICE LOCATION X

0 105.6 211.2 316.8 422.4 633.6 844.8 1056m

1:10560

REV	STAT	DESCRIPTION	DATE
C01	AP	ISSUED FOR PLANNING	02.06.2022

DRAWING STATUS: ISSUED FOR PLANNING

CHECKED BY:	REVIEWED BY:	APPROVED BY:
LC	MV	DC

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PROJECT: FERMOY WEIR REMEDIATION & FISH BYPASS CHANNEL

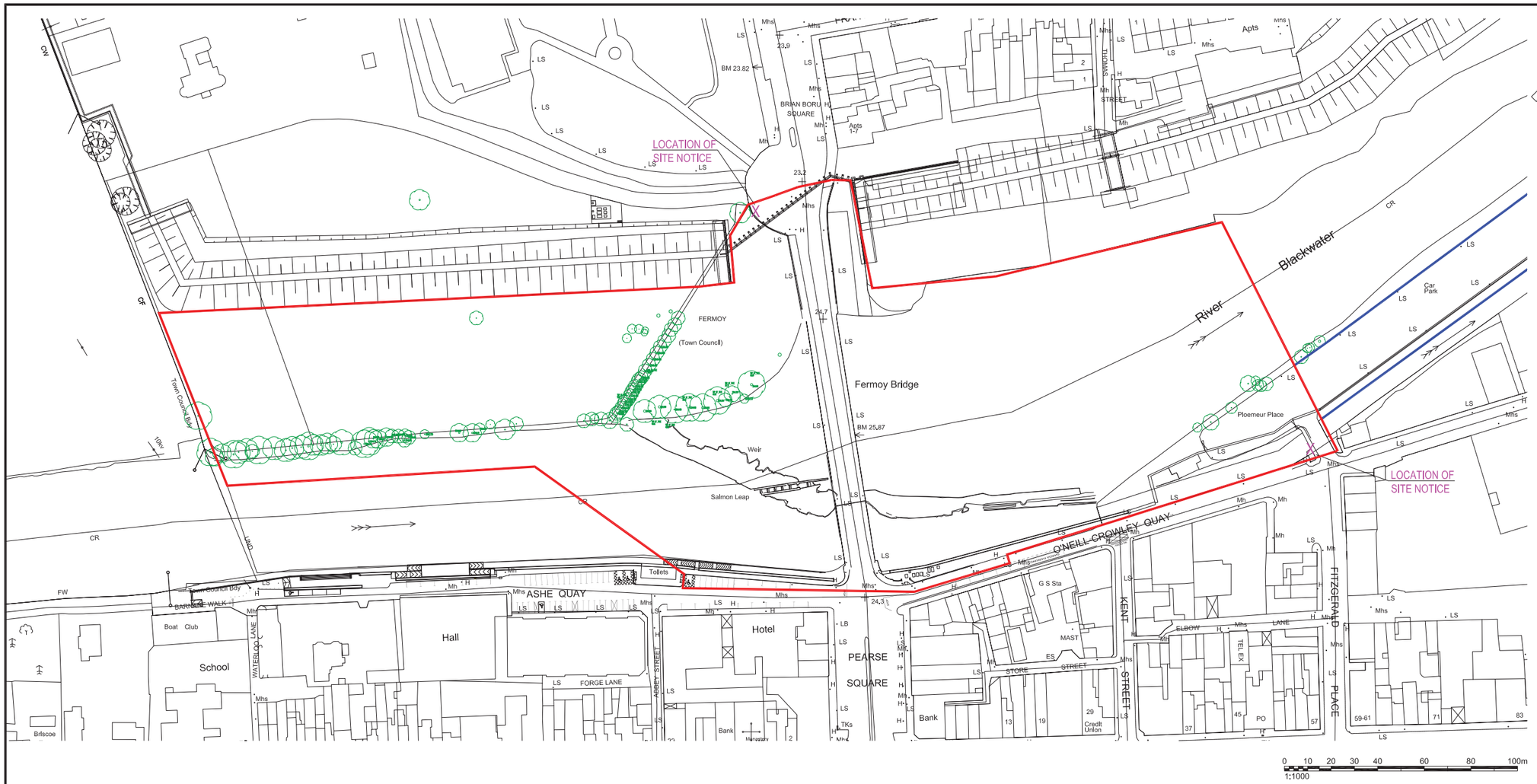
CLIENT: CORK COUNTY COUNCIL

DRAWING TITLE: SITE LOCATION MAP

SCALE: 1:10560 (A3)

PROJECT - ORIGINATOR - VOLUME - LOCATION - TYPE - ROLE - NUMBER
19011-TJOC-PL-XX-DR-C-0048

REV: C01



LEGEND:

- PLANNING RED LINE BOUNDARY
- PERMANENT WAYLEAVES
- SITE NOTICE LOCATION X
- OTHER LANDS IN THE CONTROL OF THE APPLICANT

MAP REPRODUCED BY PERMISSION OF ORDNANCE SURVEY IRELAND (CORK CCMA 9802)

REV	STAT	DESCRIPTION	DATE
C01	AP	ISSUED FOR PLANNING	02.06.2022

DRAWING STATUS: ISSUED FOR PLANNING

CHECKED BY:	REVIEWED BY:	APPROVED BY:
LC	MV	DC

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PROJECT: FERMOY WEIR REMEDIATION AND FISH BYPASS CHANNEL

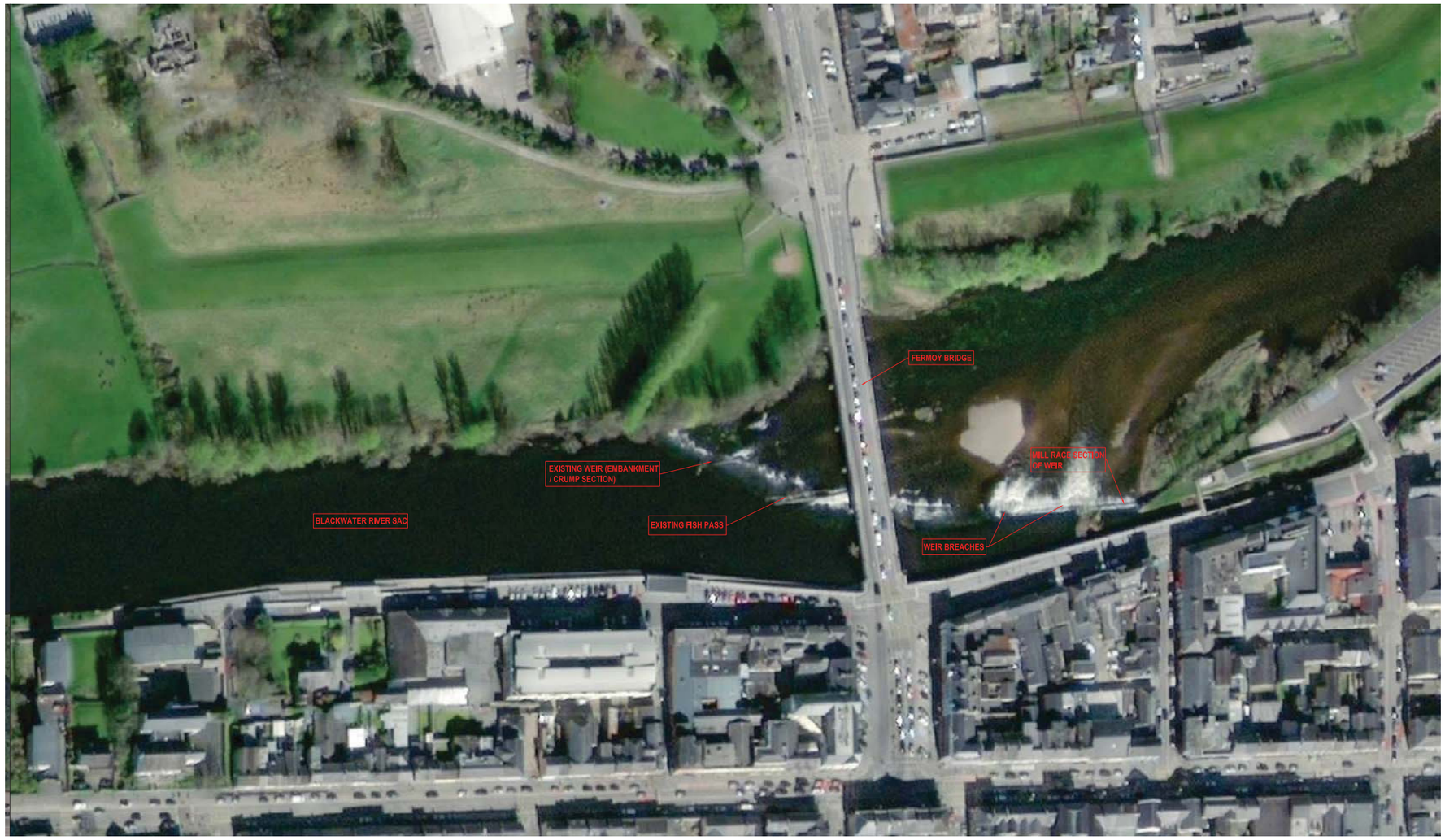
CLIENT: CORK COUNTY COUNCIL

DRAWING TITLE: SITE LOCATION PLAN

SCALE: 1:1000 (A1)

PROJECT - ORIGINATOR - VOLUME -LOCATION- TYPE - ROLE - NUMBER
19011-TJOC-PL-XX-DR-C-0049

REV: C01



N

0 10 20 30 40 60 80 100m
1:1000

Lidar Survey supplied by
Cork County Council
26th June 2018

C01	AP	ISSUED FOR PLANNING	02.06.2022
REV	STAT	DESCRIPTION	DATE

DRAWING STATUS:
ISSUED FOR PLANNING

CHECKED BY:	REVIEWED BY:	APPROVED BY:
LC	MV	DC

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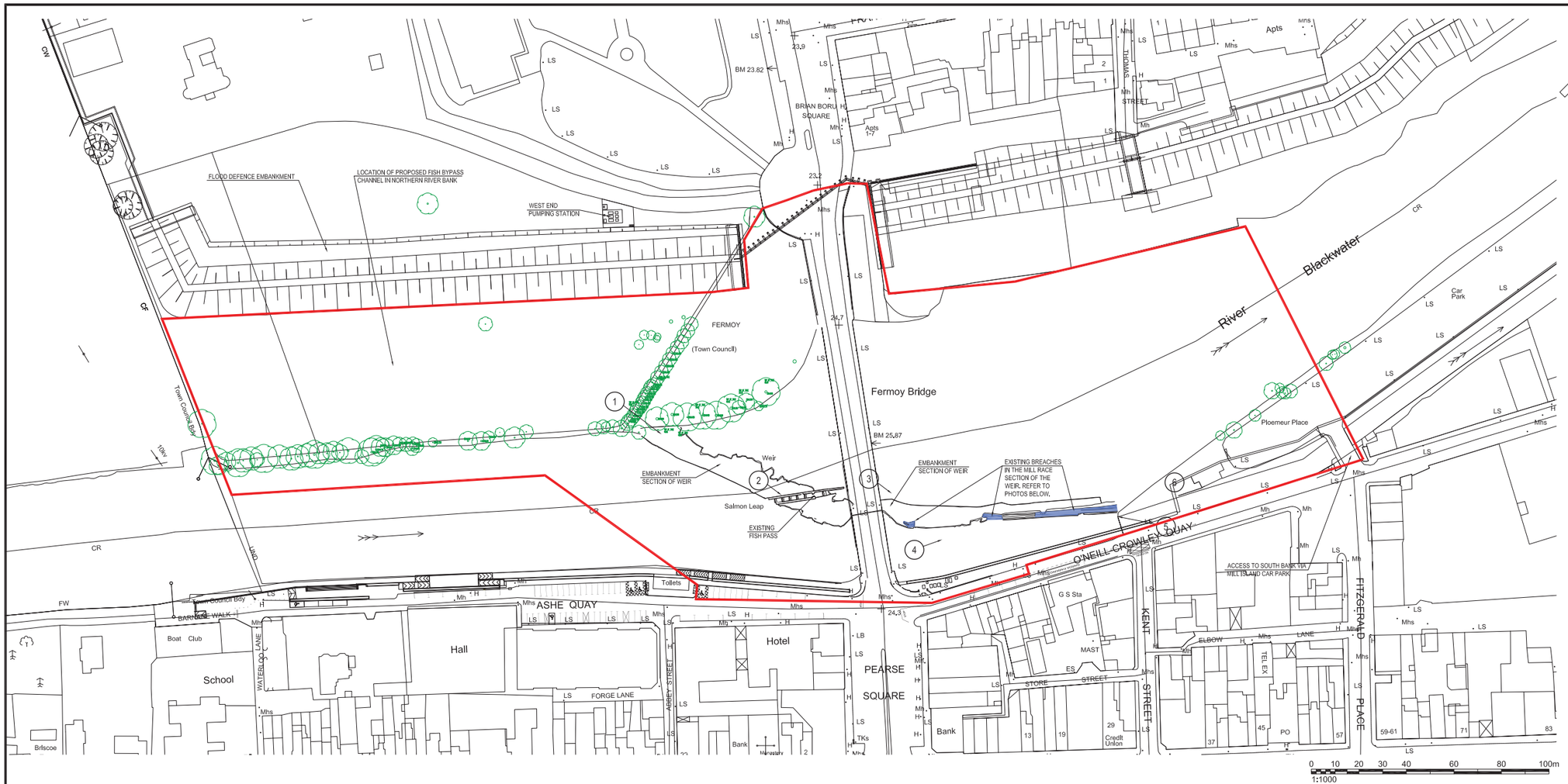
PROJECT:
FERMOY WEIR REMEDIATION AND
FISH BYPASS CHANNEL

CLIENT:
CORK COUNTY COUNCIL

DRAWING TITLE:
FERMOY WEIR
AERIAL VIEW OF EXISTING SITE

SCALE: 1:1000 (A1)

PROJECT - ORIGINATOR - VOLUME - LOCATION - TYPE - ROLE - NUMBER	REV:
19011-TJOC-PL-XX-DR-C-0050	C01



NOTES:

1. TREE INFORMATION SHOWN ON THIS DRAWING IS TAKEN FROM GEODATA SURVEYING LTD. TOPOGRAPHICAL SURVEY OF JUNE 2020.
2. EXISTING WEIR INFORMATION SHOWN ON THIS DRAWING IS TAKEN FROM WEIR SURVEY CARRIED OUT BY MURPHY GEOSPACIAL IN AUGUST 2018. EXTENT OF BREACHES SHOWN ARE AS SURVEYED IN 2018 AND MAY HAVE INCREASED IN THE TIME SINCE THE SURVEY HAD BEEN CARRIED OUT.
3. PHOTOS TAKEN IN MARCH 2021.

LEGEND:

SITE BOUNDARY

EXISTING TREES

PHOTO LOCATION AND DIRECTION (1)

EXISTING BREACHES IN WEIR

PHOTO 1 - EMBANKMENT WEIR

PHOTO 3 - INTERFACE BETWEEN EMBANKMENT AND MILL RACE WEIR

PHOTO 5 -EXISTING BREACHES IN MILL RACE SECTION OF WEIR

PHOTO 2 - EXISTING FISH LADDER

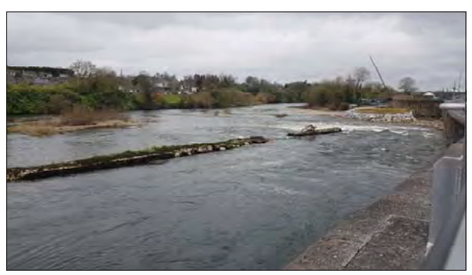


PHOTO 4 - EXISTING BREACHES IN MILL RACE SECTION OF WEIR
(LOOKING DOWNSTREAM)

PHOTO 6 -EXISTING BREACHES IN MILL RACE SECTION OF WEIR
(LOOKING UPSTREAM)

MAP REPRODUCED BY PERMISSION OF ORDNANCE SURVEY IRELAND (CORK CCMA 9802)

REV	STAT	DESCRIPTION	DATE
C01	AP	ISSUED FOR PLANNING	02.06.2022

DRAWING STATUS: ISSUED FOR PLANNING

CHECKED BY: LC | REVIEWED BY: MV | APPROVED BY: DC

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PROJECT: FERMOY WEIR REMEDIATION AND FISH BYPASS CHANNEL

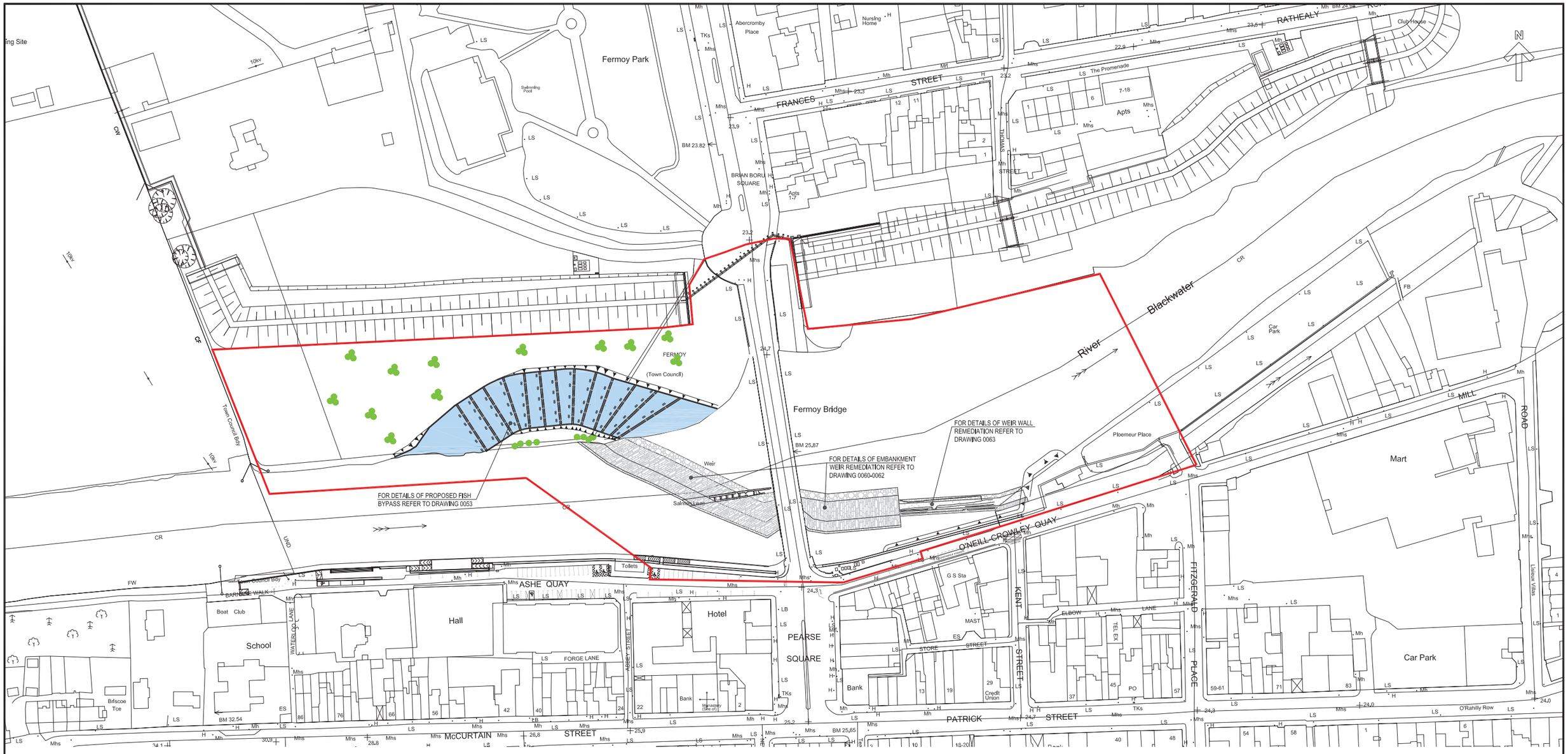
CLIENT: CORK COUNTY COUNCIL

DRAWING TITLE: EXISTING SITE LAYOUT PLAN

SCALE: 1:1000 (A1)

PROJECT - ORIGINATOR - VOLUME -LOCATION- TYPE - ROLE - NUMBER: 19011-TJOC-PL-XX-DR-C-0051

REV: C01



0 10 20 30 40 60 80 100m
1:1000

NOTES:

1. FOR DETAILS OF FISH BYPASS REFER TO DRAWING 0053.
2. FOR DETAILS OF REMEDIATION OF EMBANKMENT SECTION OF WEIR REFER TO DRAWINGS 0060-0062.
3. FOR DETAILS OF REMEDIATION TO MILL RACE SECTION OF WEIR REFER TO DRAWINGS 0060 AND 0063.

REV	STAT	DESCRIPTION	DATE
C01	AP	ISSUED FOR PLANNING	02.06.2022

DRAWING STATUS: ISSUED FOR PLANNING

CHECKED BY:	REVIEWED BY:	APPROVED BY:
LC	MV	DC

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PROJECT: FERMOY WEIR REMEDIATION AND FISH BYPASS CHANNEL

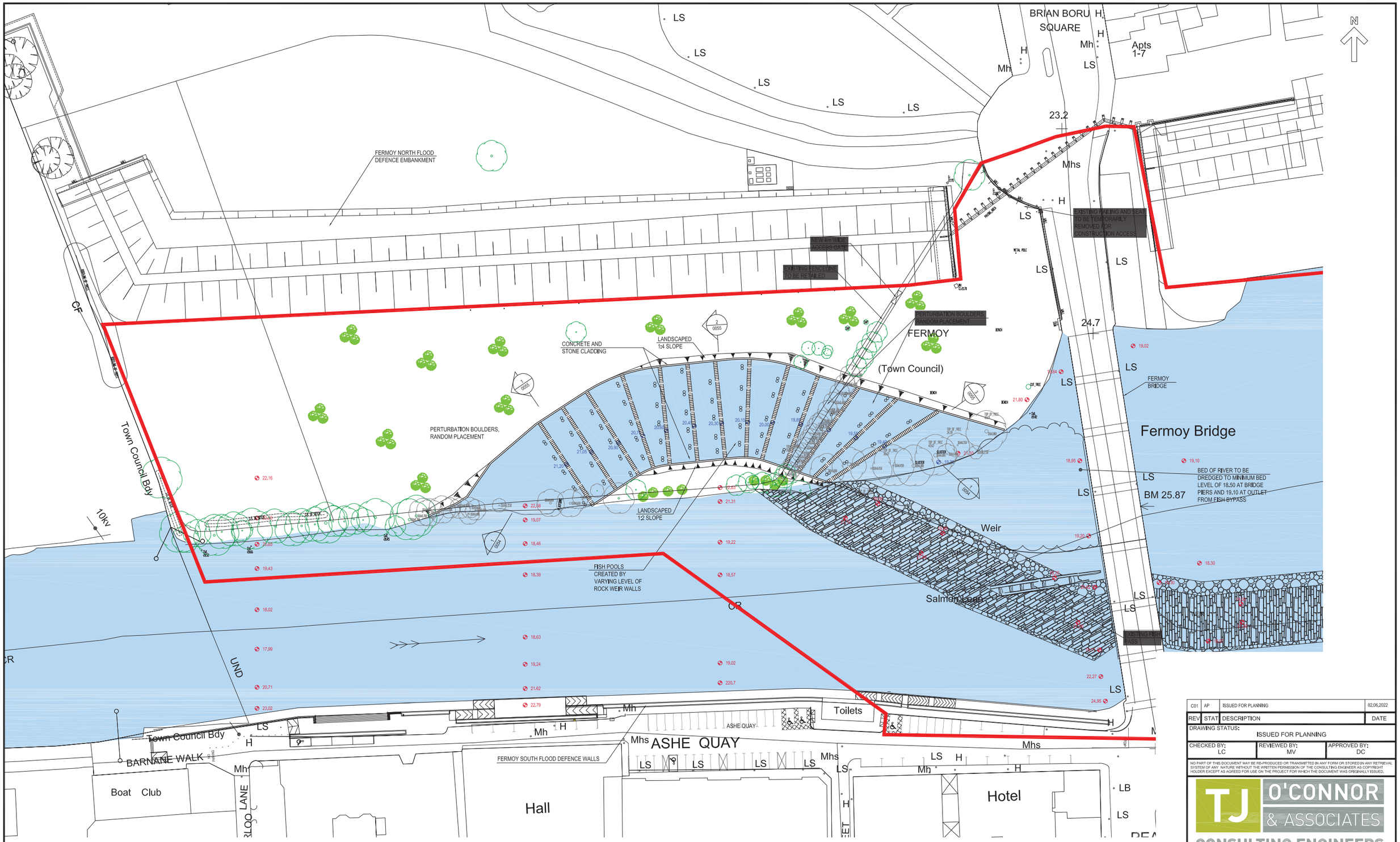
CLIENT: CORK COUNTY COUNCIL

DRAWING TITLE: KEY PLAN
PROPOSED FISH BYPASS, WEIR AND MILL ISLAND PLAN

SCALE: 1:1000 (A1)

PROJECT - ORIGINATOR - VOLUME - LOCATION - TYPE - ROLE - NUMBER
19011-TJOC-PL-XX-DR-C-0052

REV: C01



0 5 10 15 20 30 40 50m
1:500

LEGEND:

- EXISTING RIVER BED LEVELS 19,02
- PROPOSED LEVELS 19,02
- EXISTING TREES
- EXISTING TREES TO BE REMOVED
- PROPOSED PLANTING

NOTES:

1. REFER TO DRAWINGS 0054 AND 0055 FOR SECTION DETAILS OF PROPOSED FISH BYPASS CHANNEL.
2. ALL LEVELS SHOWN RELATE TO ORDNANCE DATUM MALIN HEAD.

REV	STAT	DESCRIPTION	DATE
C01	AP	ISSUED FOR PLANNING	02.06.2022

DRAWING STATUS: ISSUED FOR PLANNING

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LC	MV	DC

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PROJECT: FERMOY WEIR REMEDIATION AND FISH BYPASS CHANNEL

CLIENT: CORK COUNTY COUNCIL

DRAWING TITLE: PROPOSED FISH BYPASS PLAN

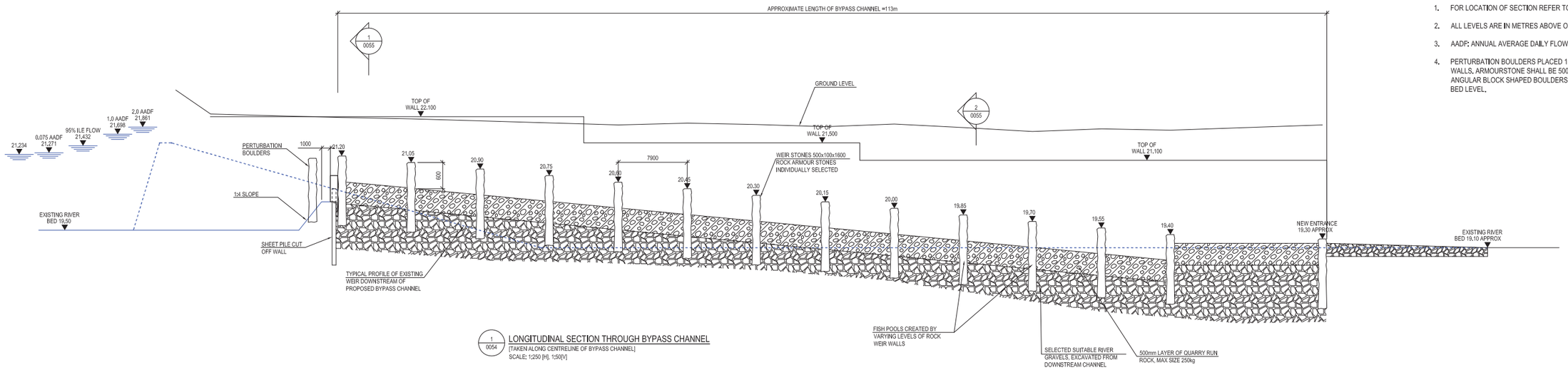
SCALE: 1:500 (A1)

PROJECT - ORIGINATOR - VOLUME - LOCATION - TYPE - ROLE - NUMBER
19011-TJOC-XX-XX-DR-C-0053

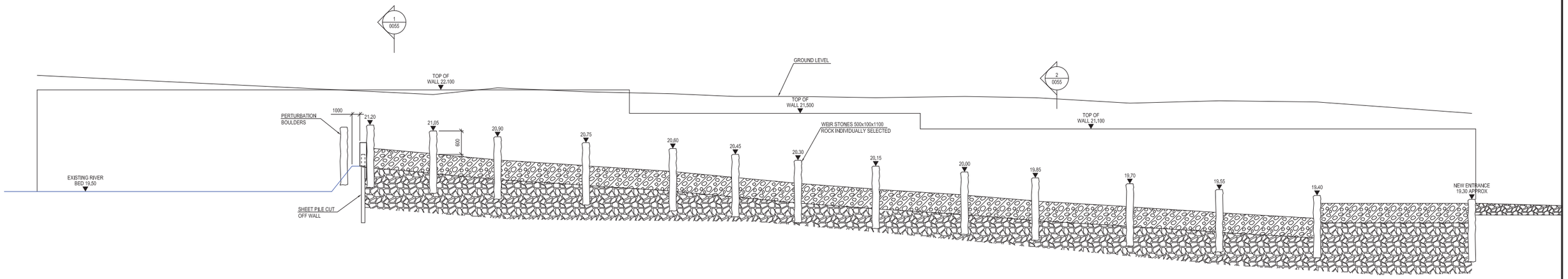
REV: C01

NOTES:

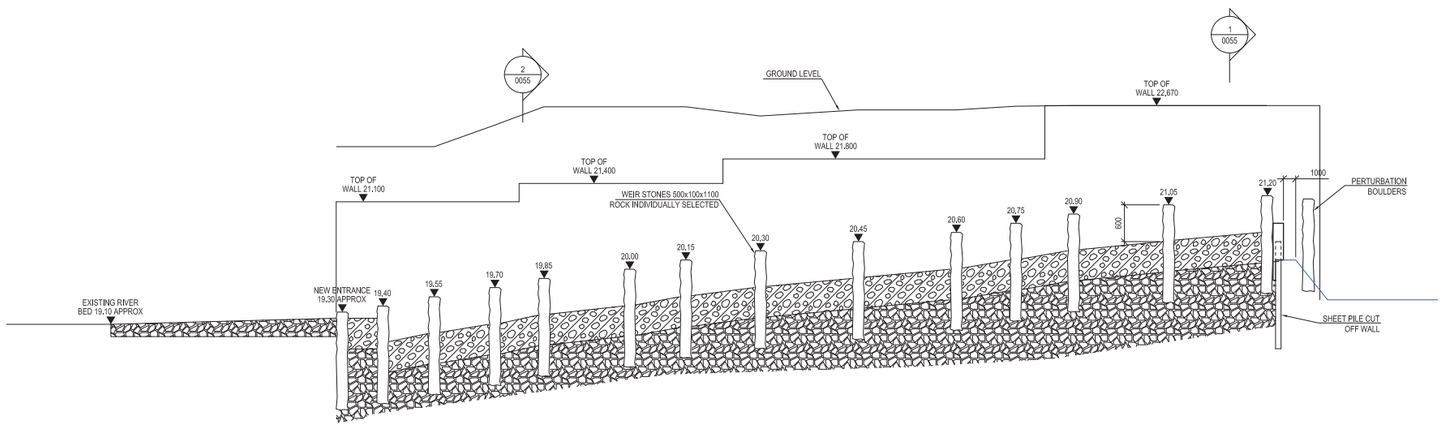
1. FOR LOCATION OF SECTION REFER TO DRAWING 0053.
2. ALL LEVELS ARE IN METRES ABOVE ORDNANCE DATUM MALIN HEAD.
3. AADF: ANNUAL AVERAGE DAILY FLOW
4. PERTURBATION BOULDERS PLACED 1m UPSTREAM OF GAPS IN THE WEIR WALLS. ARMOURSTONE SHALL BE 500x1000x1600 HIGH MIN. DIMENSIONS ANGULAR BLOCK SHAPED BOULDERS PROJECTION 500mm ABOVE THE RAMP BED LEVEL.



1 0054 LONGITUDINAL SECTION THROUGH BYPASS CHANNEL
[TAKEN ALONG CENTRELINE OF BYPASS CHANNEL]
SCALE: 1:250 [H], 1:50[V]



2 0054 ELEVATION OF NORTHERN WALL OF BYPASS CHANNEL
SCALE: 1:250 [H], 1:50[V]



3 0054 ELEVATION OF SOUTHERN WALL OF BYPASS CHANNEL
SCALE: 1:250 [H], 1:50[V]

REV	STAT	DESCRIPTION	DATE
C01	AP	ISSUED FOR PLANNING	02.06.2022

DRAWING STATUS: ISSUED FOR PLANNING

CHECKED BY:	REVIEWED BY:	APPROVED BY:
LC	MV	DC

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PROJECT: FERMOY WEIR REMEDIATION AND FISH BYPASS CHANNEL

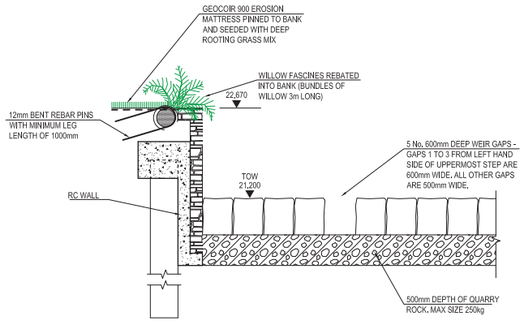
CLIENT: CORK COUNTY COUNCIL

DRAWING TITLE: PROPOSED FISH BYPASS LONGITUDINAL SECTION

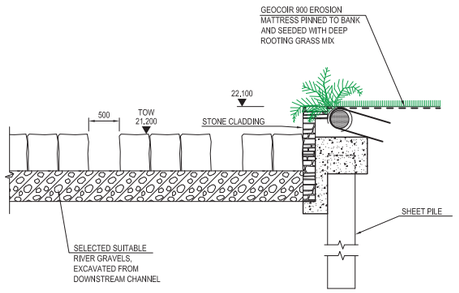
SCALE: 1:250 [H], 1:50 [V] (A1)

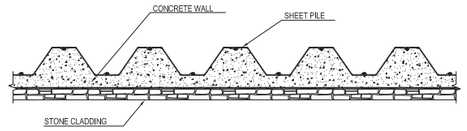
PROJECT - ORIGINATOR - VOLUME - LOCATION - TYPE - ROLE - NUMBER
19011-TJOC-XX-XX-DR-C-0054

REV: C01



1 / 0055 SECTION
SCALE: 1:50

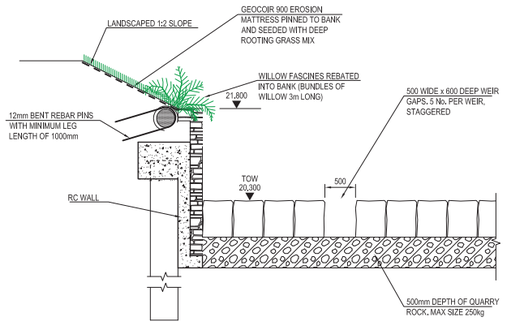




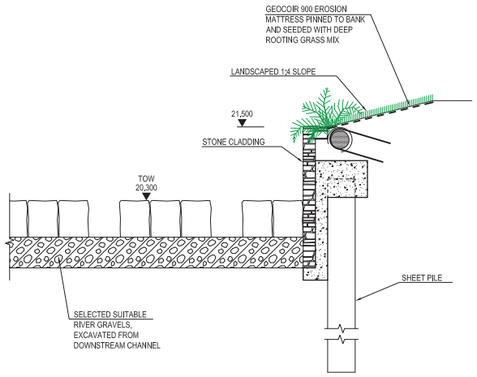
4 / 0055 DETAIL PART PLAN OF SHEET PILE WALL
SCALE: 1:50

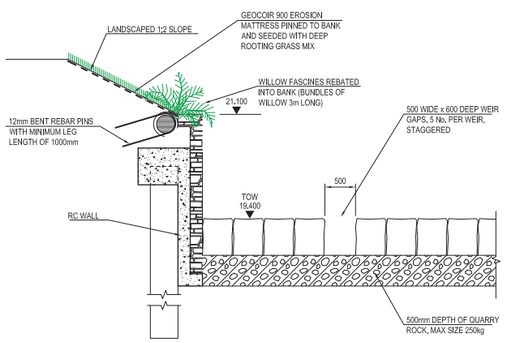
NOTES:

1. FOR LOCATION OF SECTIONS REFER TO DRAWING 0053.
2. ALL LEVELS ARE IN METERS ABOVE ORDNANCE DATUM MALIN HEAD

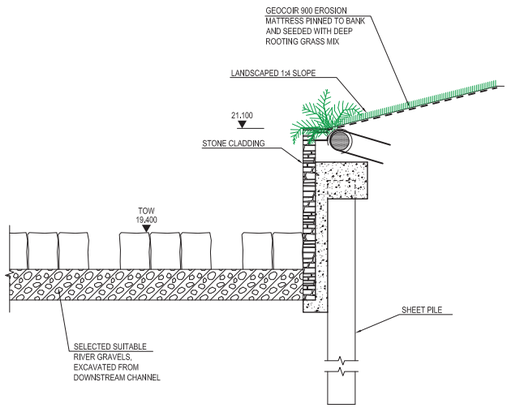


2 / 0055 SECTION
SCALE: 1:50





3 / 0055 SECTION
SCALE: 1:50



REV	STAT	DESCRIPTION	DATE
C01	AP	ISSUED FOR PLANNING	02.06.2022

DRAWING STATUS: ISSUED FOR PLANNING

CHECKED BY: LC | REVIEWED BY: MV | APPROVED BY: DC

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PROJECT: FERMOY WEIR REMEDIATION AND FISH BYPASS CHANNEL

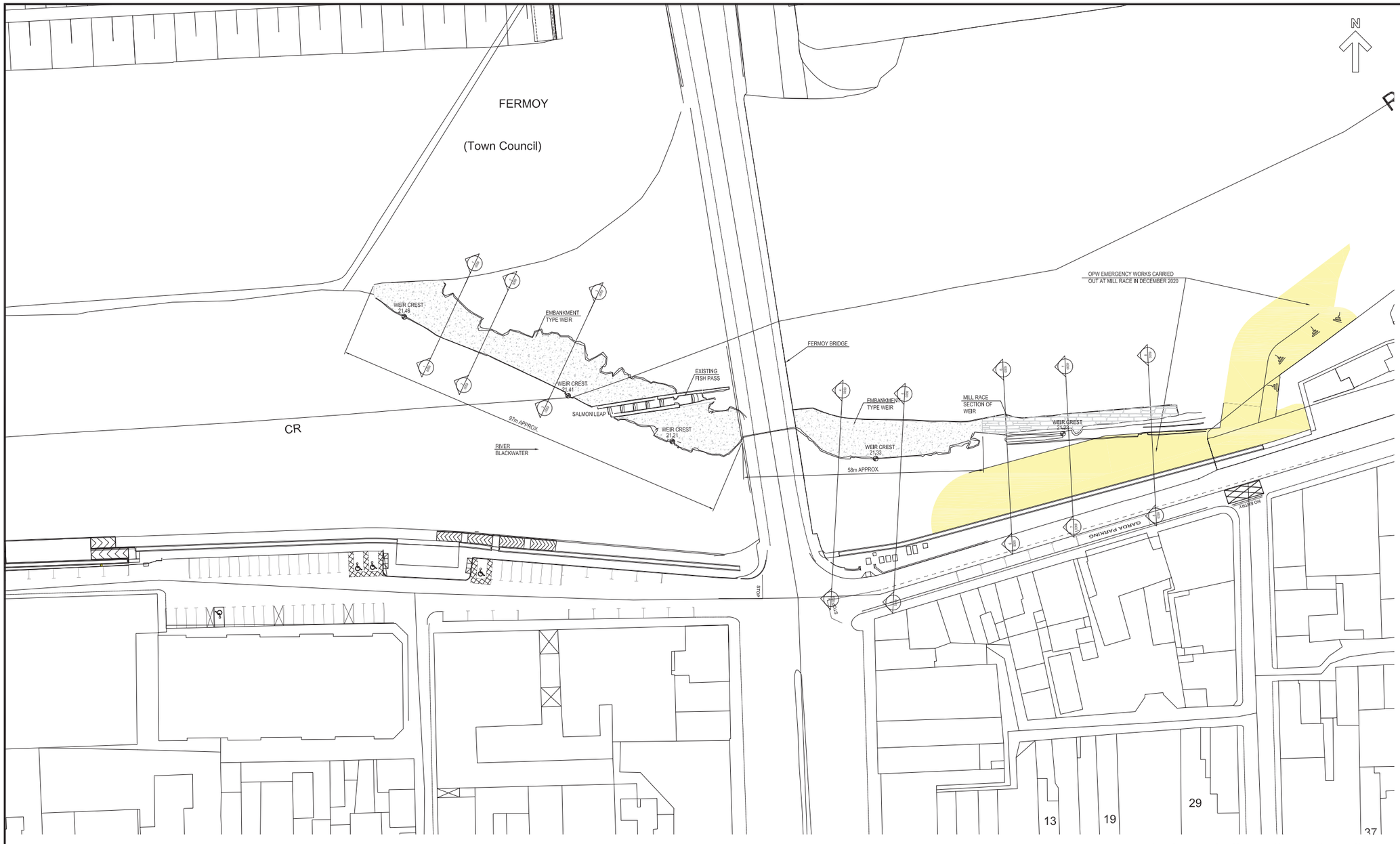
CLIENT: CORK COUNTY COUNCIL

DRAWING TITLE: FISH BYPASS SECTIONS

SCALE: 1:50 (A1)

PROJECT - ORIGINATOR - VOLUME -LOCATION- TYPE -ROLE- NUMBER
19011-TJOC-XX-XX-DR-C-0055

REV: C01



N

NOTES:

1. EXTENT OF EXISTING WEIR BASE ON TOPOGRAPHICAL SURVEY UNDERTAKEN BY MURPHY GEOSPACIAL IN AUGUST 2018.
2. FOR SECTIONS THROUGH EXISTING WEIR REFER TO DRAWING 0059.

APPROXIMATE EXTENT OF BED STABILISATION WORKS UNDERTAKEN BY THE OPW IN 2020

0 5 10 15 20 30 40 50m
1:500

MAP REPRODUCED BY PERMISSION OF ORDNANCE SURVEY IRELAND (CORK CCMA 9802)

REV	SUIT	DESCRIPTION	DATE
C01	AP	ISSUED FOR PLANNING	02.06.2022

DRAWING STATUS: ISSUED FOR PLANNING

CHECKED BY:	REVIEWED BY:	APPROVED BY:
LC	MV	DC

TJ O'CONNOR & ASSOCIATES
CONSULTING ENGINEERS
CORRIG HOUSE, CORRIG ROAD, SANDYFORD, DUBLIN 18.
Tel: 01-295 2321 Fax: 01-295 4541 Email: tjoc@tjoc.ie Web: www.tjoc.ie

PROJECT: FERMOY EMBANKMENT WEIR REMEDIATION AND FISH BYPASS CHANNEL

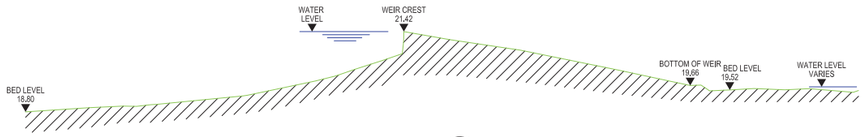
CLIENT: CORK COUNTY COUNCIL

DRAWING TITLE: WEIR REMEDIATION PLAN OF EXISTING WEIR

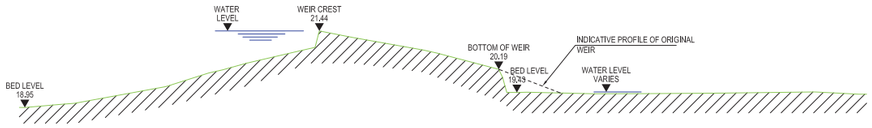
SCALE: 1:500 (A1)

PROJECT - ORIGINATOR - VOLUME -LOCATION- TYPE -ROLE- NUMBER
19011-TJOC-PL-XX-DR-C-0058

REV: C01



1 / 0059 EXISTING EMBANKMENT WEIR SECTION
SCALE: 1:100



2 / 0059 EXISTING EMBANKMENT WEIR SECTION
SCALE: 1:100

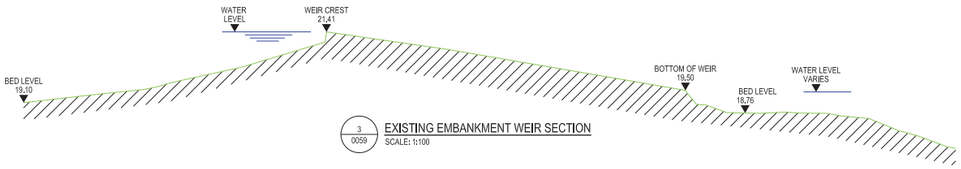
NOTES:

1. FOR LOCATION OF SECTIONS REFER TO DRAWING 0058.
2. ALL LEVELS SHOWN ARE IN METERS ABOVE ORDNANCE DATUM, MALIN HEAD.
3. AUGUST 2018 AND AUGUST 2020 SURVEYS OF THE RIVER BED AND WEIR UNDERTAKEN BY MURPHY GEOSPATIAL AND CARRIED OUT TO ITM.
4. AUG 2018 SURVEY DRAWING REFERENCE 27232 18024_Fermoy_Welr
5. AUG 2020 SURVEY DRAWING REFERENCE MSL37760_01
6. SECTIONS SHOW APPROXIMATE BED PROFILE FOLLOWING WORKS COMPLETED BY OPW IN AUTUMN 2020.

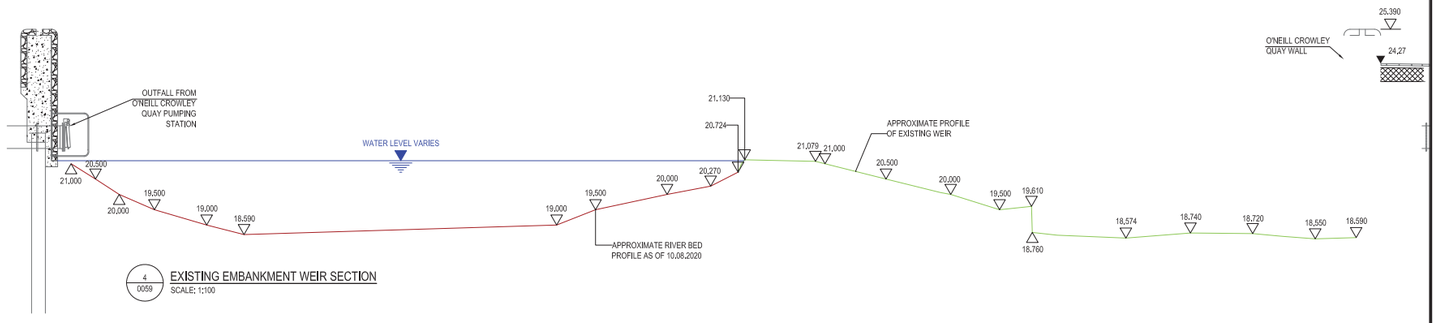
LEGEND:

AUGUST 2018 SURVEY PROFILE

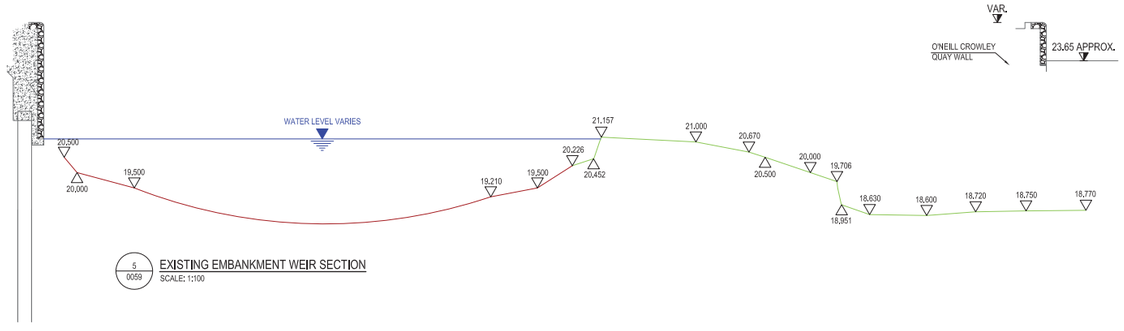
AUGUST 2020 SURVEY BED PROFILE



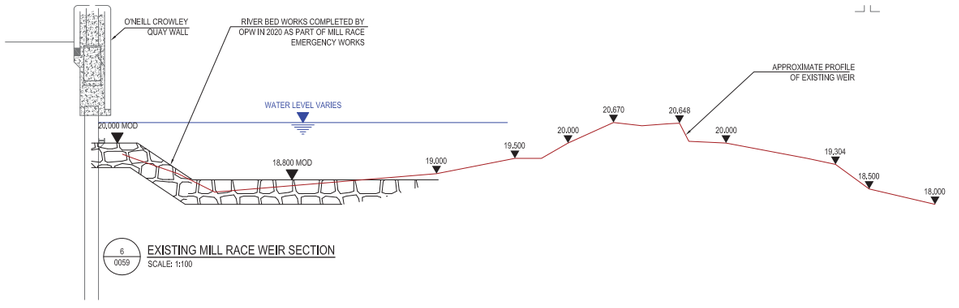
3 / 0059 EXISTING EMBANKMENT WEIR SECTION
SCALE: 1:100



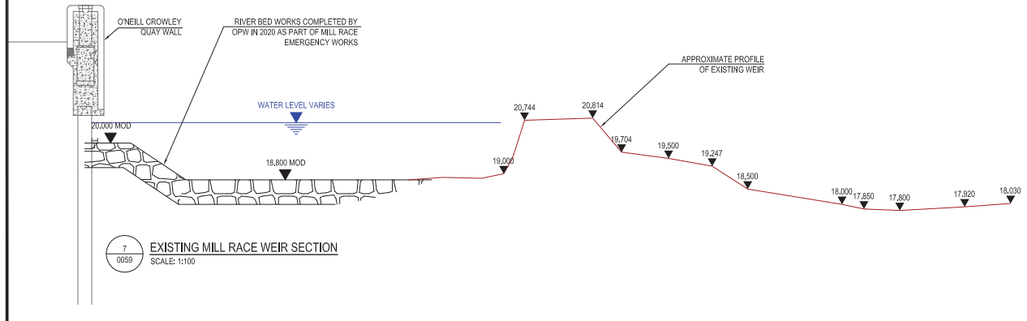
4 / 0059 EXISTING EMBANKMENT WEIR SECTION
SCALE: 1:100



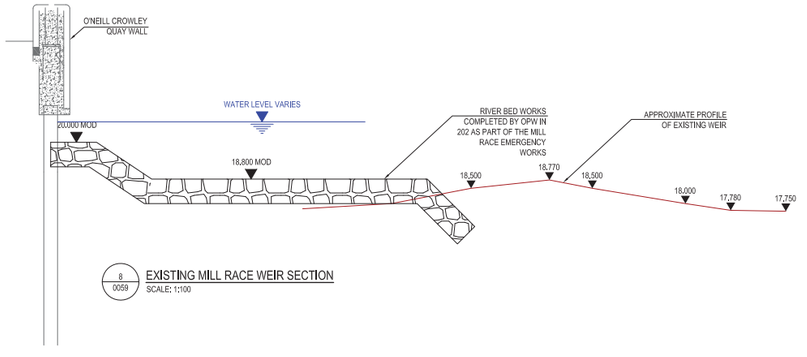
5 / 0059 EXISTING EMBANKMENT WEIR SECTION
SCALE: 1:100



6 / 0059 EXISTING MILL RACE WEIR SECTION
SCALE: 1:100



7 / 0059 EXISTING MILL RACE WEIR SECTION
SCALE: 1:100



8 / 0059 EXISTING MILL RACE WEIR SECTION
SCALE: 1:100

REV	SUIT	DESCRIPTION	DATE
C01	AP	ISSUED FOR PLANNING	02.06.2022

DRAWING STATUS: ISSUED FOR PLANNING

CHECKED BY:	REVIEWED BY:	APPROVED BY:
LC	MV	DC

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CORRIG HOUSE, CORRIG ROAD, SANDYFORD, DUBLIN 18.
Tel: 01-295 2321 Fax: 01-295 4541 Email: tjoc@tjoc.ie Web: www.tjoc.ie

PROJECT: FERMOY WEIR REMEDIATION AND FISH BYPASS CHANNEL

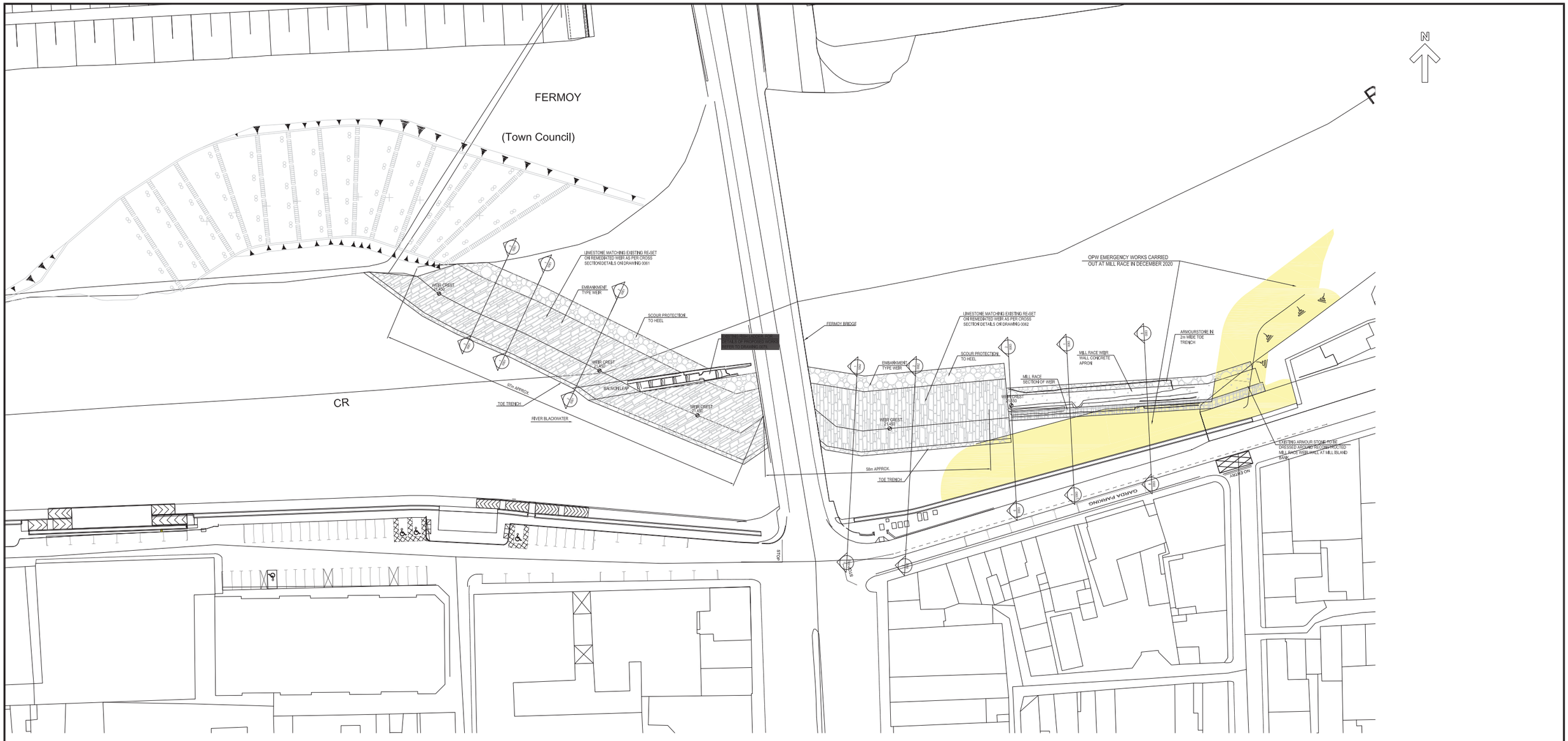
CLIENT: CORK COUNTY COUNCIL

DRAWING TITLE: PROPOSED WEIR REMEDIATION EXISTING SECTIONS

SCALE: AS SHOWN (A1)

PROJECT - ORIGINATOR - VOLUME - LOCATION - TYPE - ROLE - NUMBER
19011-TJOC-PL-XX-DR-C-0059

REV: C01



0 5 10 15 20 30 40 50m
1:500

NOTES:

1. FOR SECTIONS THROUGH PROPOSED EMBANKMENT WEIR REFER TO DRAWINGS 0061 AND 0062.
2. FOR SECTIONS THROUGH PROPOSED MILL RACE WEIR REFER TO DRAWING 0063.
3. ALL LEVELS ARE IN METRES ABOVE ORDNANCE DATUM MALIN HEAD.
4. WEIR REMEDIATION SHALL BE UNDERTAKEN IN ACCORDANCE WITH THE CONSERVATION ENGINEER'S RECOMMENDATIONS.

APPROXIMATE EXTENT OF BED STABILISATION WORKS UNDERTAKEN BY THE OPW IN 2020

MAP REPRODUCED BY PERMISSION OF ORDNANCE SURVEY IRELAND (CORK CCMA 9802)

REV	SUIT	DESCRIPTION	DATE
C01	AP	ISSUED FOR PLANNING	02.06.2022

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PROJECT: FERMOY EMBANKMENT WEIR REMEDIATION AND FISH BYPASS CHANNEL

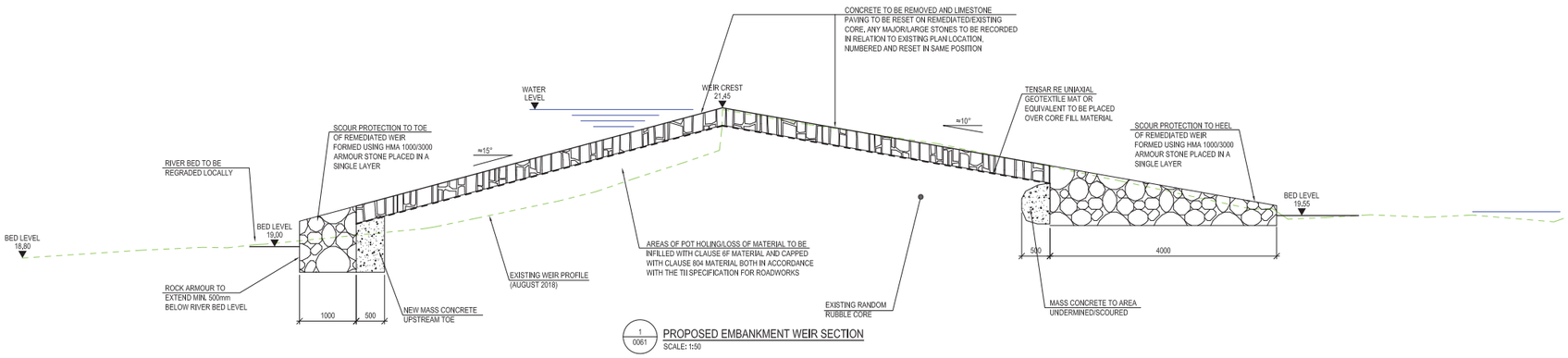
CLIENT: CORK COUNTY COUNCIL

DRAWING TITLE: WEIR REMEDIATION PLAN OF PROPOSED WEIR

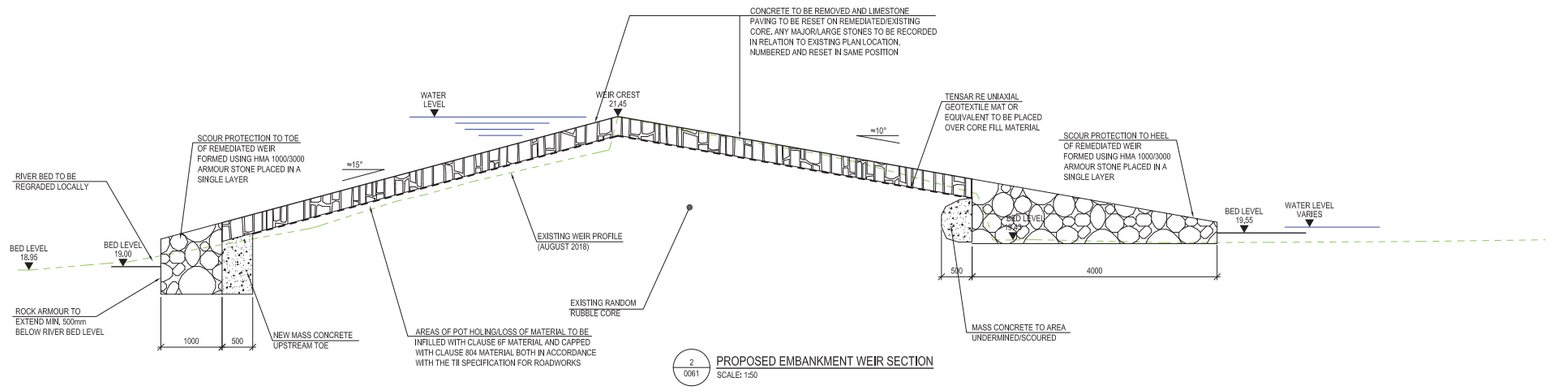
SCALE: 1:500 (A1)

PROJECT - ORIGINATOR - VOLUME - LOCATION - TYPE - ROLE - NUMBER
19011-TJOC-PL-XX-DR-C-0060

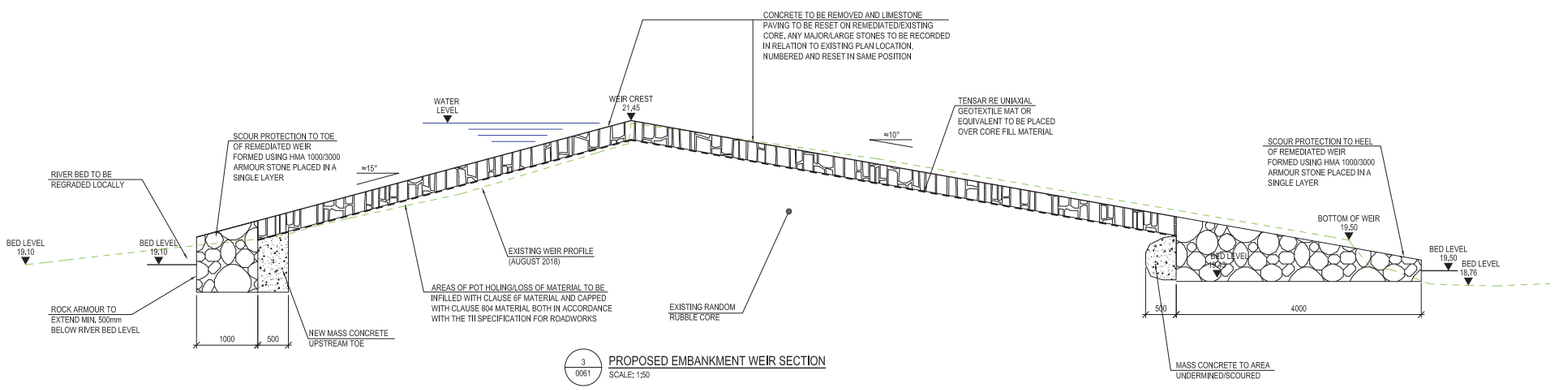
REV: C01



1 / 0061 PROPOSED EMBANKMENT WEIR SECTION
SCALE: 1:50



2 / 0061 PROPOSED EMBANKMENT WEIR SECTION
SCALE: 1:50



3 / 0061 PROPOSED EMBANKMENT WEIR SECTION
SCALE: 1:50

NOTES:

1. ALL LEVELS SHOWN ARE IN METERS ABOVE ORDNANCE DATUM, MALIN HEAD.
2. FOR LOCATIONS OF SECTIONS REFER TO DRAWING 0060.
3. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH SURVEY DRAWINGS OF EXISTING WEIR STRUCTURE AND WITH SECTION DRAWINGS 0062 AND 0063.
4. WEIR REMEDIATION SHALL BE UNDERTAKEN IN ACCORDANCE WITH THE CONSERVATION ENGINEER'S RECOMMENDATIONS.

REV	SUIT	DESCRIPTION	DATE
C01	AP	ISSUED FOR PLANNING	02.06.2022

DRAWING STATUS: ISSUED FOR PLANNING

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PROJECT: FERMOY WEIR REMEDIATION AND FISH BYPASS CHANNEL

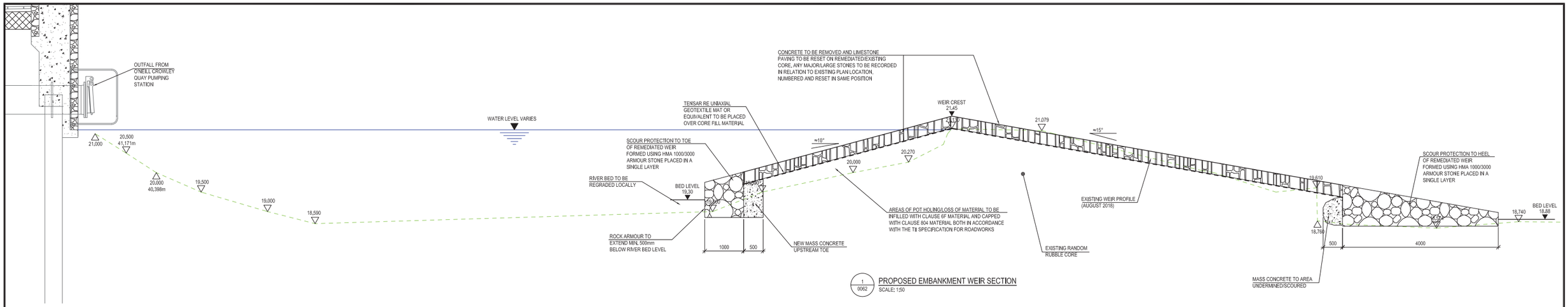
CLIENT: CORK COUNTY COUNCIL

DRAWING TITLE: WEIR REMEDIATION PROPOSED SECTIONS

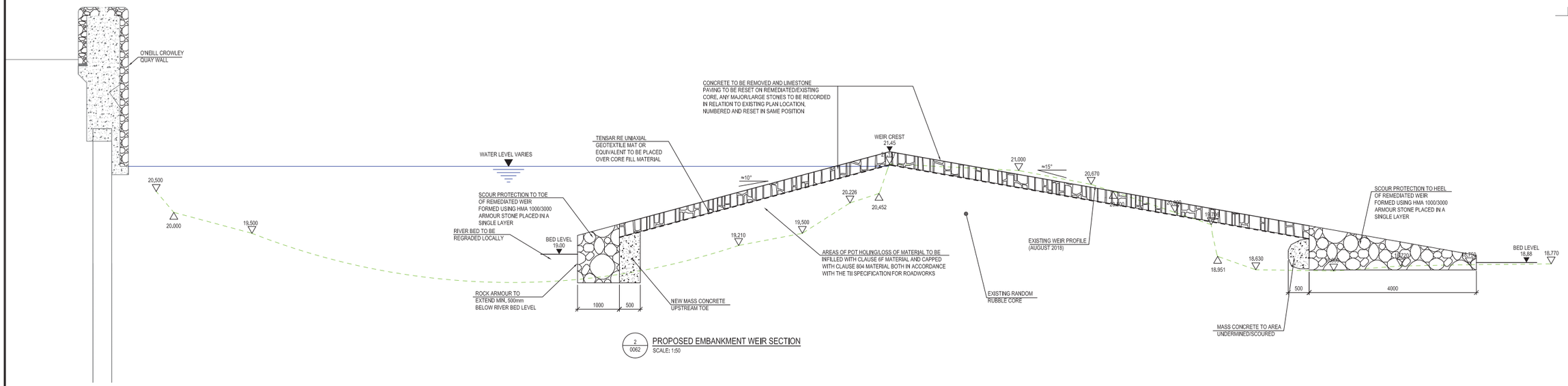
SCALE: AS SHOWN (A1)

PROJECT - ORIGINATOR - VOLUME - LOCATION - TYPE - ROLE - NUMBER
19011-TJOC-PL-XX-DR-C-0061

REV: C01



1/0062 PROPOSED EMBANKMENT WEIR SECTION
SCALE: 1:50



2/0062 PROPOSED EMBANKMENT WEIR SECTION
SCALE: 1:50

NOTES:

1. ALL LEVELS SHOWN ARE IN METERS ABOVE ORDNANCE DATUM, MALIN HEAD.
2. FOR LOCATIONS OF SECTIONS REFER TO DRAWING 0060.
3. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH SURVEY DRAWINGS OF EXISTING WEIR STRUCTURE AND WITH SECTION DRAWINGS 0061 AND 0063.
4. WEIR REMEDIATION SHALL BE UNDERTAKEN IN ACCORDANCE WITH THE CONSERVATION ENGINEER'S RECOMMENDATIONS.

REV	SUIT	DESCRIPTION	DATE
C01	AP	ISSUED FOR PLANNING	02.06.2022

DRAWING STATUS: ISSUED FOR PLANNING

CHECKED BY:	REVIEWED BY:	APPROVED BY:
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Tel: 01-295 2321 Fax: 01-295 4541 Email: tjoc@tjoc.ie Web: www.tjoc.ie

PROJECT: FERMOY WEIR REMEDIATION AND FISH BYPASS CHANNEL

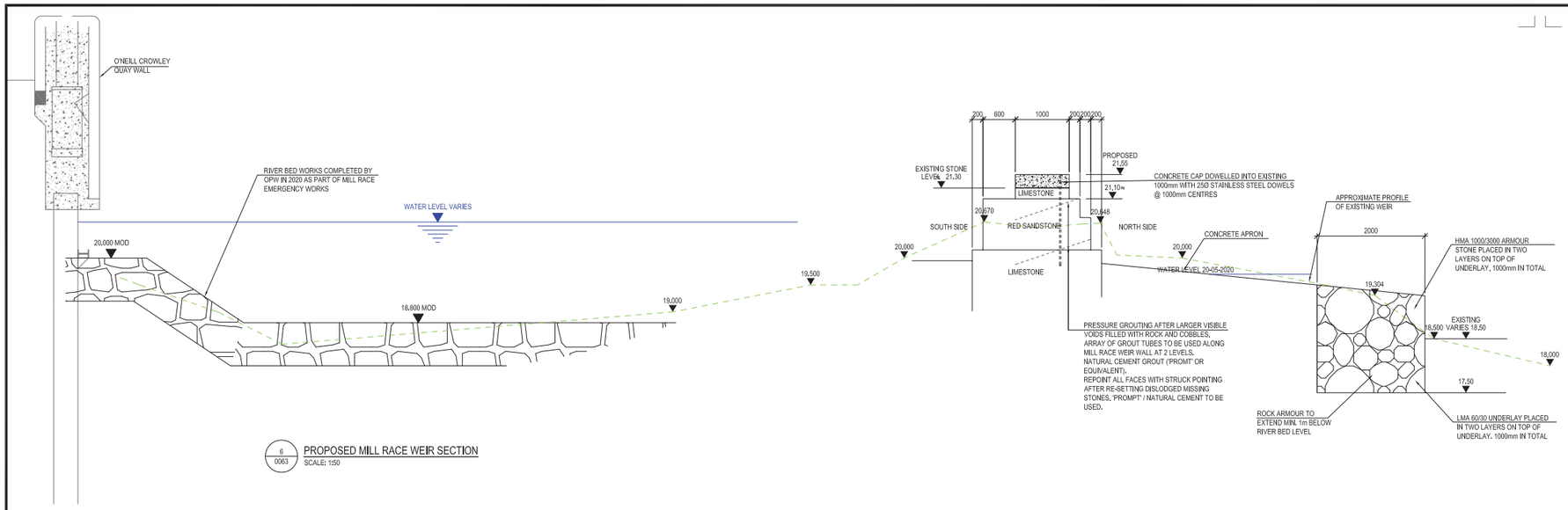
CLIENT: CORK COUNTY COUNCIL

DRAWING TITLE: WEIR REMEDIATION PROPOSED SECTIONS

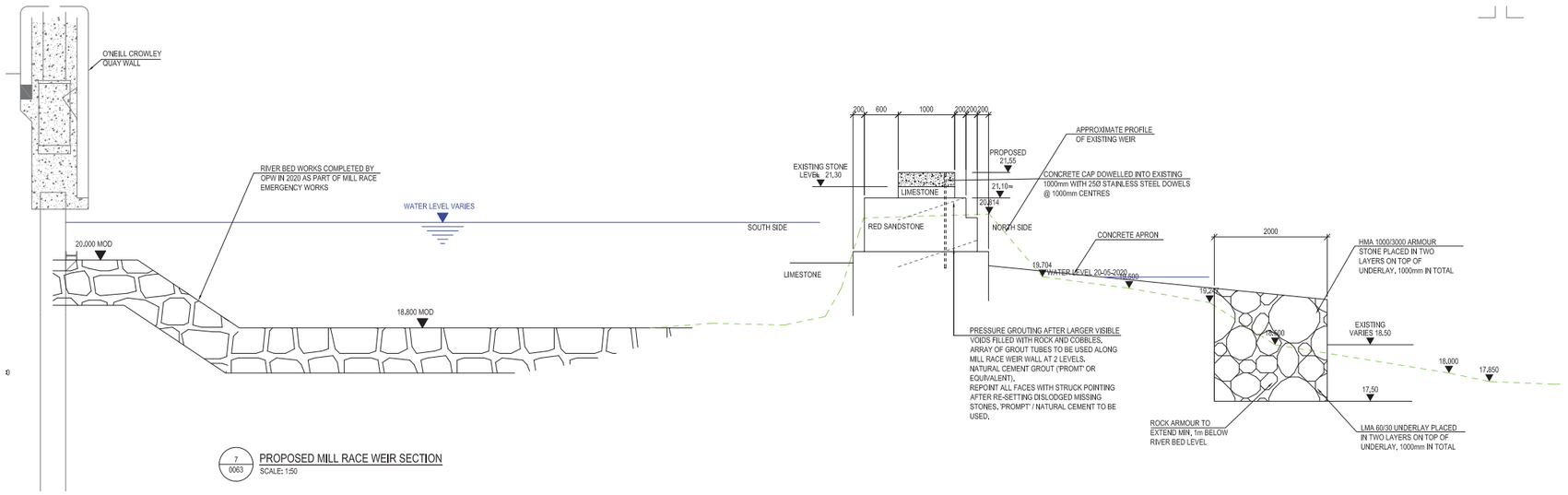
SCALE: AS SHOWN (A1)

PROJECT - ORIGINATOR - VOLUME - LOCATION - TYPE - ROLE - NUMBER: 19011-TJOC-PL-XX-DR-C-0062

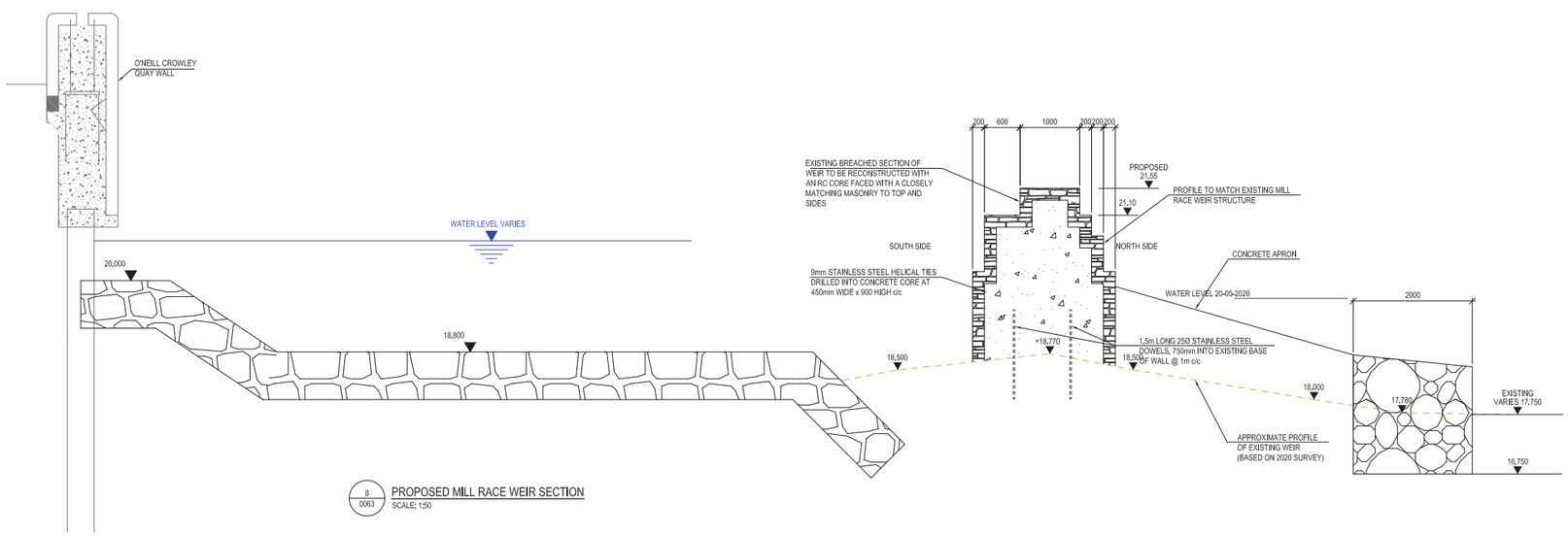
REV: C01



6/0063 PROPOSED MILL RACE WEIR SECTION
SCALE: 1:50



7/0063 PROPOSED MILL RACE WEIR SECTION
SCALE: 1:50



8/0063 PROPOSED MILL RACE WEIR SECTION
SCALE: 1:50

NOTES:

1. ALL LEVELS SHOWN ARE IN METERS ABOVE ORDNANCE DATUM, MALIN HEAD.
2. FOR LOCATIONS OF SECTIONS REFER TO DRAWING 0060.
3. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH SURVEY DRAWINGS OF EXISTING WEIR STRUCTURE AND WITH SECTION DRAWINGS 0061 AND 0062.
4. WEIR REMEDIATION SHALL BE UNDERTAKEN IN ACCORDANCE WITH THE CONSERVATION ENGINEER'S RECOMMENDATIONS.

REV	SUIT	DESCRIPTION	DATE
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PROJECT: FERMOY WEIR REMEDIATION AND FISH BYPASS CHANNEL

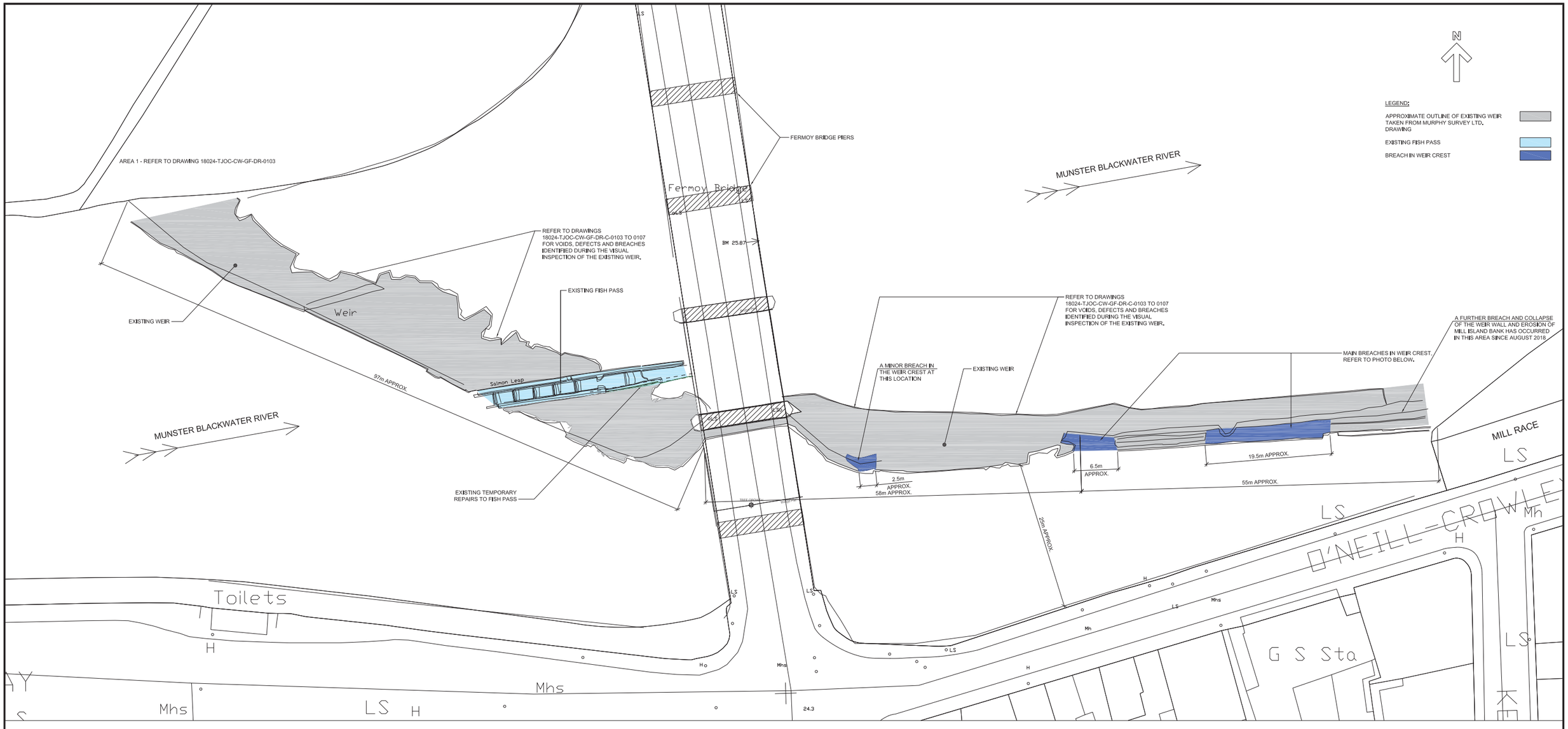
CLIENT: CORK COUNTY COUNCIL

DRAWING TITLE: WEIR REMEDIATION PROPOSED SECTIONS

SCALE: AS SHOWN (A1)

PROJECT - ORIGINATOR - VOLUME - LOCATION - TYPE - ROLE - NUMBER
19011-TJOC-PL-XX-DR-C-0063

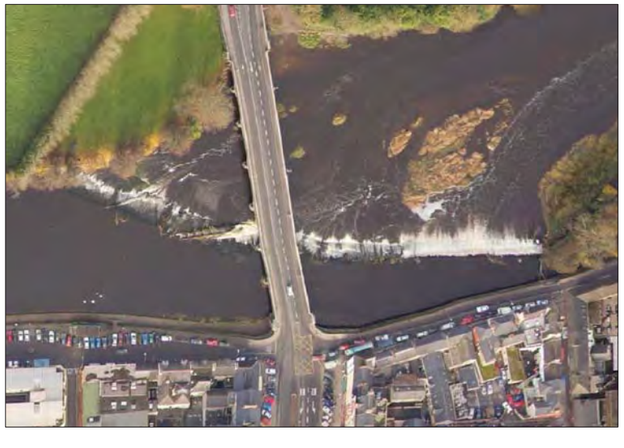
REV: C01



1 / 0073 EXISTING WEIR LAYOUT
SCALE: 1:300

0 3 6 9 12 18 24 30m
1:300

2 / 0073 PHOTO OF EXISTING WEIR ON EAST SIDE OF FERMOY BRIDGE



3 / 0073 AERIAL PHOTO OF FERMOY WEIR

NOTES:

1. REFER TO DRAWINGS 19011-TJOC-PL-XX-DR-C-0074 TO 0078 FOR FURTHER NOTES AND PHOTOGRAPHS.
2. DIMENSIONS SHOWN ON DRAWING ARE APPROXIMATE ONLY AND ARE BASED ON THE SURVEY UNDERTAKEN BY MURPHY SURVEYS LTD ON 23rd AUGUST 2018.
3. COMMENTS AND PHOTOGRAPHS ON THE CONDITION OF THE WEIR ARE BASED ON A VISUAL INSPECTION OF THE WEIR ON 15th AUGUST 2018. NO OPENING UP WORKS OF ANY KIND WERE UNDERTAKEN DURING THE VISUAL INSPECTION.

REV	SUIT	DESCRIPTION	DATE
C01	AP	ISSUED FOR PLANNING	02.06.2022

DRAWING STATUS: ISSUED FOR PLANNING

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Tel: 01-295 2321 Fax: 01-295 4541 Email: tjoc@tjoc.ie Web: www.tjoc.ie

PROJECT: FERMOY WEIR REMEDIATION

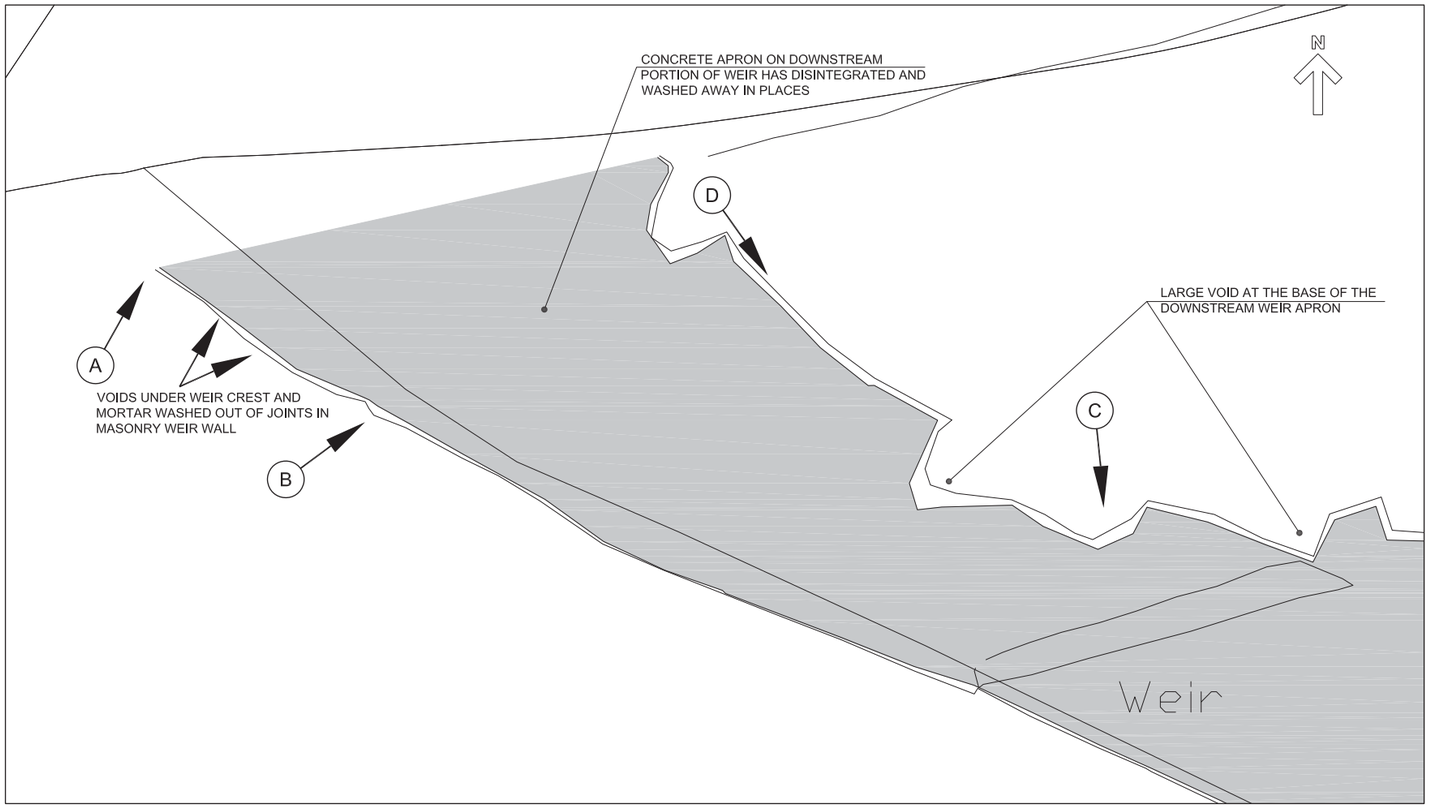
CLIENT: CORK COUNTY COUNCIL

DRAWING TITLE: SUMMARY OF EXISTING WEIR CONDITION IN 2018

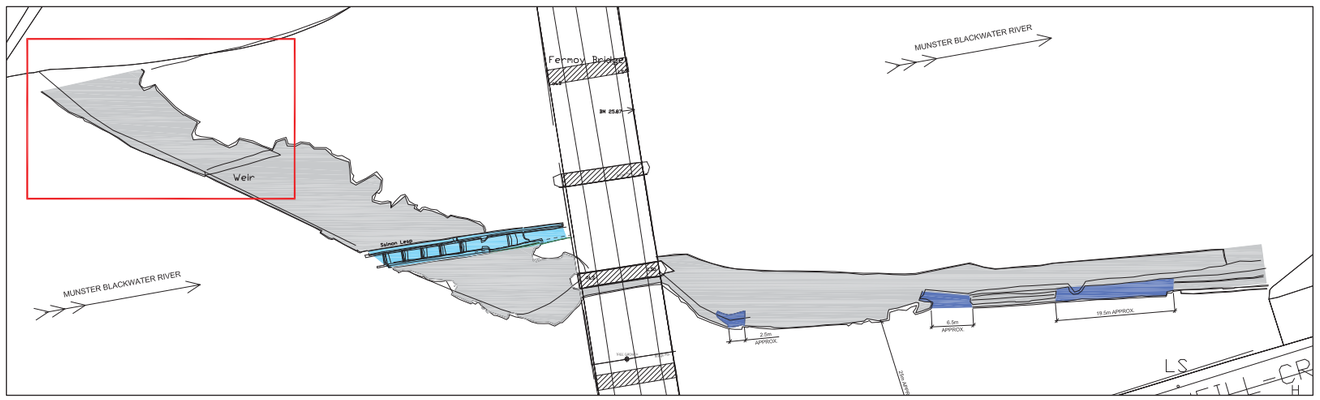
SCALE: 1:300 (A1)

PROJECT - ORIGINATOR - VOLUME - LOCATION - TYPE - ROLE - NUMBER
19011-TJOC-PL-XX-DR-C-0073

REV: C01



1 / 0074 EXISTING WEIR LAYOUT - AREA 1
SCALE: 1:100



2 / 0074 KEYPLAN - AREA 1
SCALE: 1:500

A / 0074 VOIDS UNDER WEIR CREST

B / 0074 MORTAR AND FINES WASHED OUT OF JOINTS IN MASONRY WEIR WALLS

C / 0074 LARGE VOID AT THE BASE OF THE DOWNSTREAM WEIR APRON

D / 0074 CONCRETE APRON OF WEIR HAS DISINTEGRATED AND WASHED AWAY IN PLACES

NOTES:

1. COMMENTS AND PHOTOGRAPHS ON THE CONDITION OF THE WEIR ARE BASED ON A VISUAL INSPECTION OF THE WEIR ON 15th AUGUST 2018. NO OPENING UP WORKS OF ANY KIND WERE UNDERTAKEN DURING THE VISUAL INSPECTION.

REV	SUIT	DESCRIPTION	DATE
C01	AP	ISSUED FOR PLANNING	02.06.2022

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Tel: 01-295 2321 Fax: 01-295 4541 Email: tjoc@tjoc.ie Web: www.tjoc.ie

PROJECT: FERMOY WEIR REMEDIATION

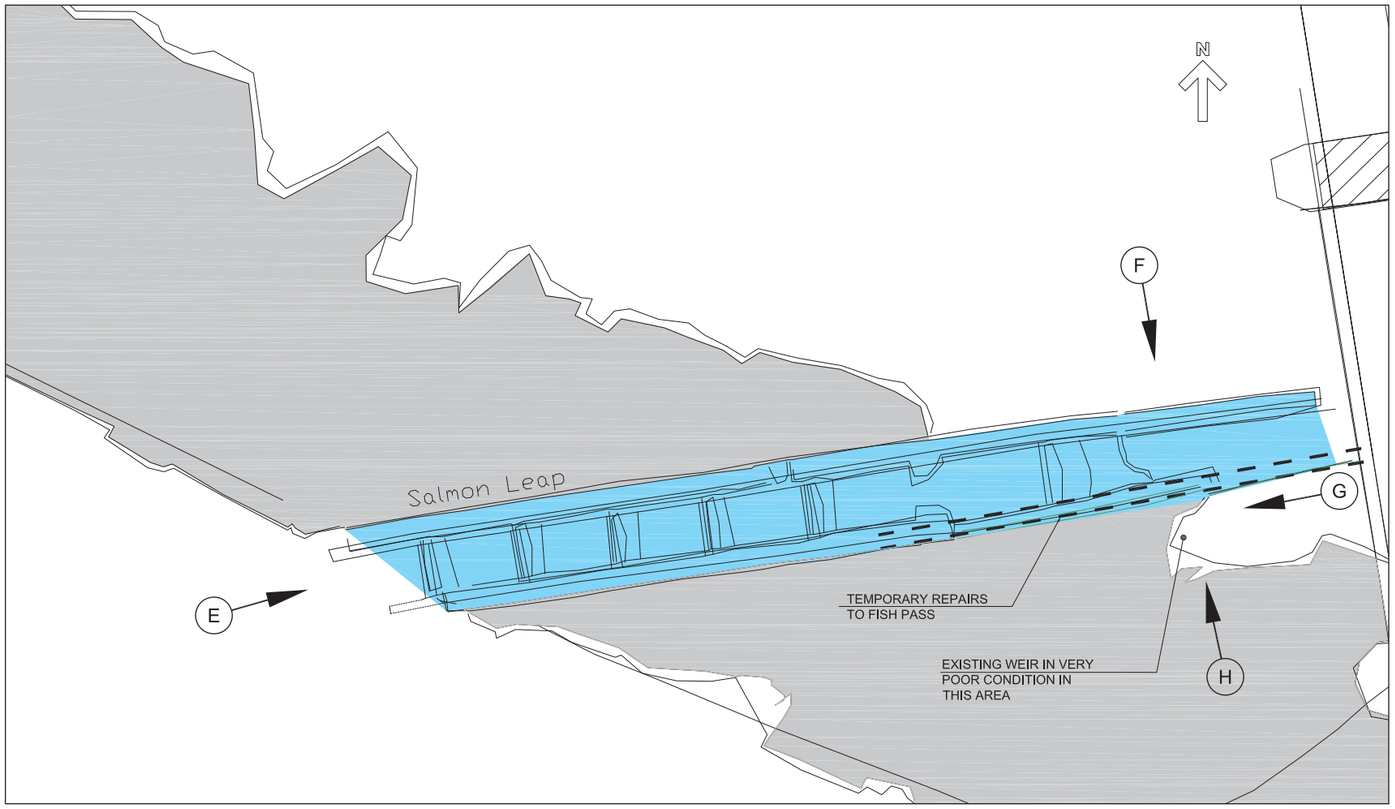
CLIENT: CORK COUNTY COUNCIL

DRAWING TITLE: EXISTING WEIR CONDITION AREA 1

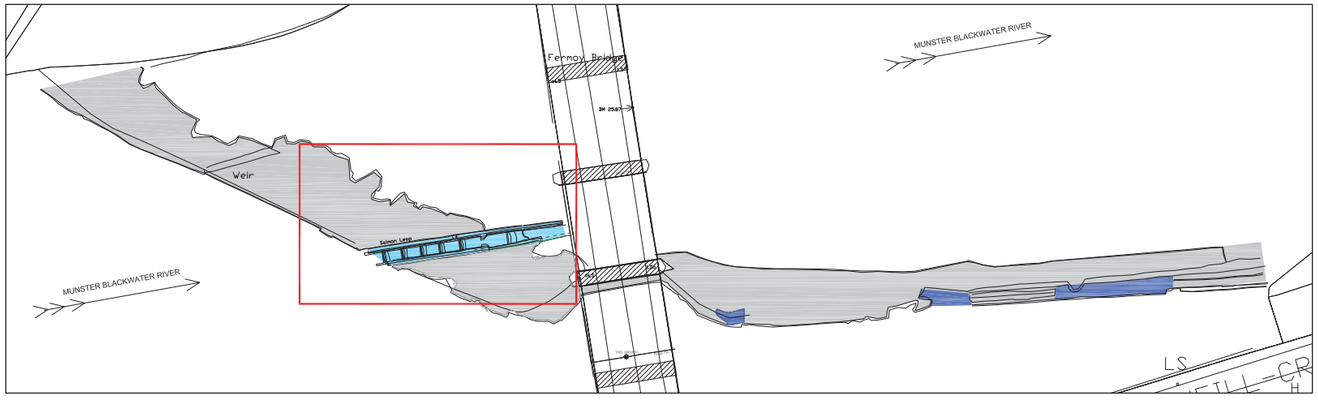
SCALE: 1:100 (A1)

PROJECT - ORIGINATOR - VOLUME - LOCATION - TYPE - ROLE - NUMBER
19011-TJOC-PL-XX-DR-C-0074

REV: C01



1 0075 EXISTING WEIR LAYOUT - AREA 2
SCALE: 1:100



2 0075 KEYPLAN - AREA 2
SCALE: 1:500

E 0075 VIEW OF UPSTREAM END OF FISH PASS

F 0075 VIEW OF DAMAGE TO FISH PASS WALL

G 0075 WEIR APRON HAS DISINTEGRATED AND WASHED AWAY

H 0075 VIEW OF TEMPORARY REPAIRS TO FISH PASS AND DISLODGED MATERIAL FROM WEIR

NOTES:

1. COMMENTS AND PHOTOGRAPHS ON THE CONDITION OF THE WEIR ARE BASED ON A VISUAL INSPECTION OF THE WEIR ON 15th AUGUST 2018, NO OPENING UP WORKS OF ANY KIND WERE UNDERTAKEN DURING THE VISUAL INSPECTION.

REV	SUIT	DESCRIPTION	DATE
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Tel: 01-295 2321 Fax: 01-295 4541 Email: tjoc@tjoc.ie Web: www.tjoc.ie

PROJECT: FERMOY WEIR REMEDIATION

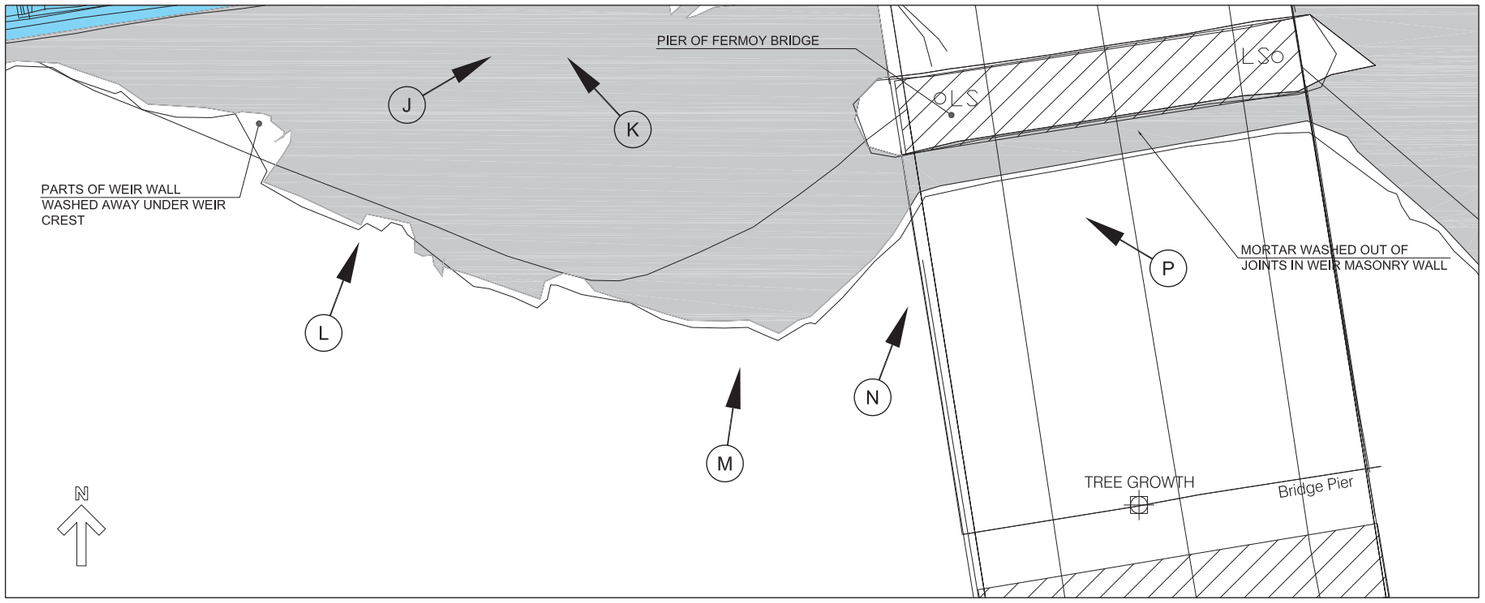
CLIENT: CORK COUNTY COUNCIL

DRAWING TITLE: EXISTING WEIR CONDITION
AREA 2

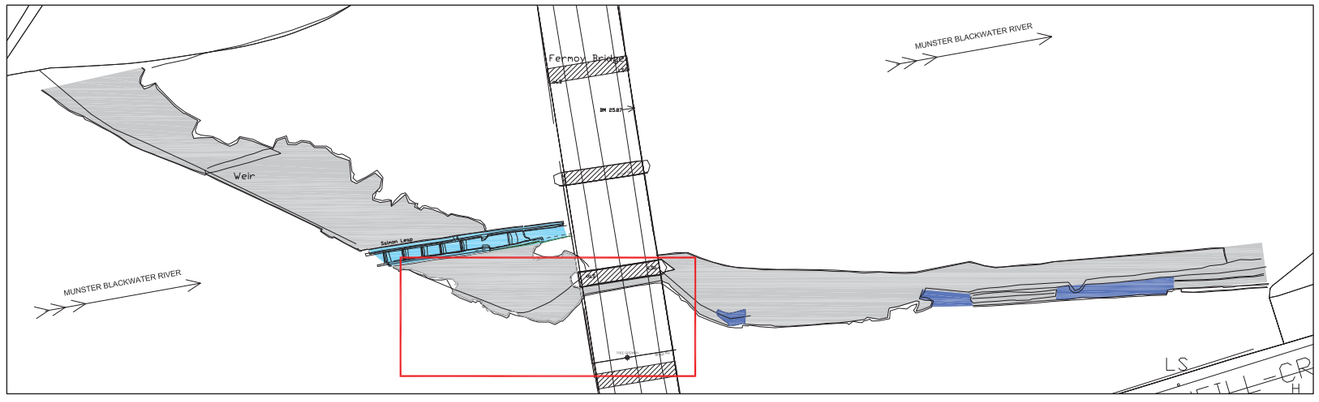
SCALE: 1:100 (A1)

PROJECT - ORIGINATOR - VOLUME - LOCATION - TYPE - ROLE - NUMBER
19011-TJOC-PL-XX-DR-C-0075

REV: C01



1/0076 EXISTING WEIR LAYOUT - AREA 3
SCALE: 1:100



2/0076 KEYPLAN - AREA 3
SCALE: 1:500

M/0076 PART OF WEIR WALL WASHED AWAY UNDER WEIR CREST

N/0076 MORTAR AND FINES WASHED OUT OF MASONRY WEIR WALL ADJACENT TO FERMOY BRIDGE

P/0076 MORTAR AND FINES WASHED OUT OF MASONRY WEIR WALL ADJACENT TO FERMOY BRIDGE

J/0076 WEIR APRON DISINTEGRATED AND WASHED AWAY AT JUNCTION WITH FISH PASS

K/0076 WEIR APRON DISINTEGRATED AND WASHED AWAY AT JUNCTION WITH FISH PASS

L/0076 PART OF WEIR WALL WASHED AWAY UNDER WEIR CREST

NOTES:

1. COMMENTS AND PHOTOGRAPHS ON THE CONDITION OF THE WEIR ARE BASED ON A VISUAL INSPECTION OF THE WEIR ON 15th AUGUST 2018. NO OPENING UP WORKS OF ANY KIND WERE UNDERTAKEN DURING THE VISUAL INSPECTION.

REV	SUIT	DESCRIPTION	DATE
C01	AP	ISSUED FOR PLANNING	02.06.2022

DRAWING STATUS: ISSUED FOR PLANNING

CHECKED BY:	REVIEWED BY:	APPROVED BY:
LC	MV	DC

TJ O'CONNOR & ASSOCIATES
CONSULTING ENGINEERS
CORRIG HOUSE, CORRIG ROAD, SANDYFORD, DUBLIN 18.
Tel: 01-295 2321 Fax: 01-295 4541 Email: tjoc@tjoc.ie Web: www.tjoc.ie

PROJECT: FERMOY WEIR REMEDIATION

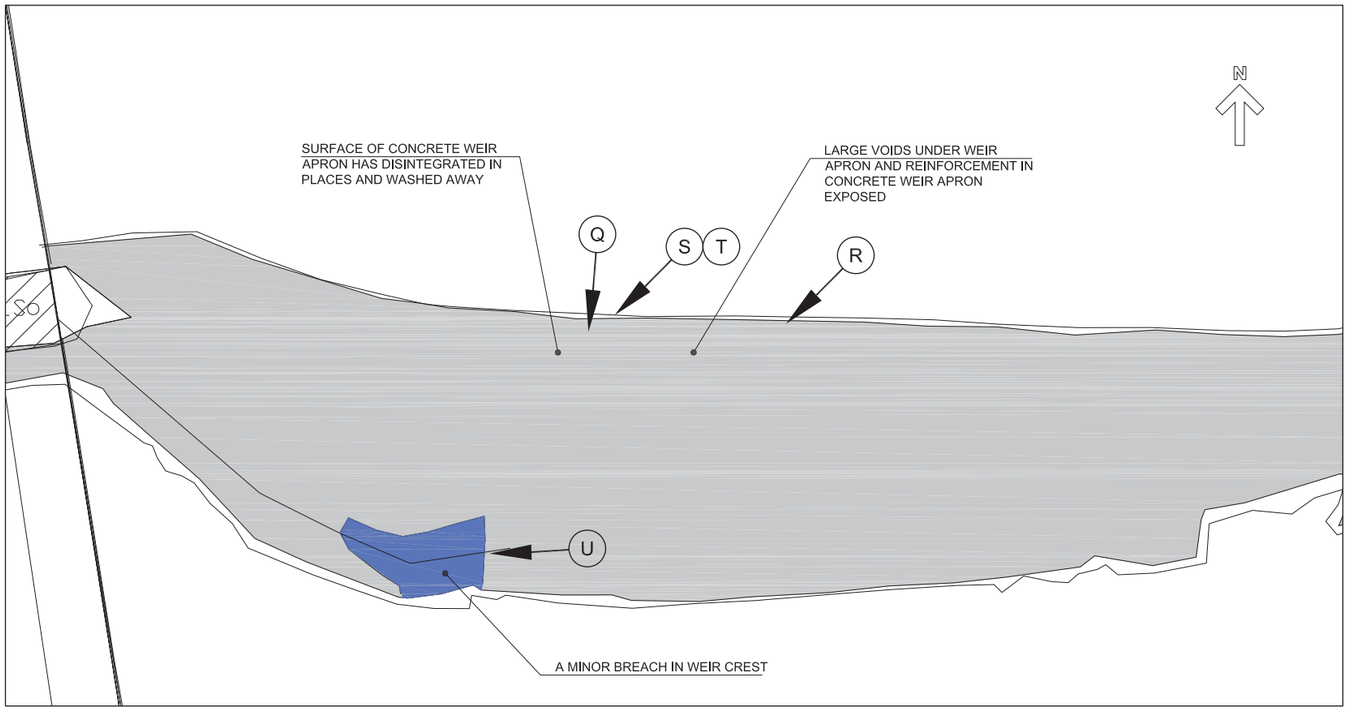
CLIENT: CORK COUNTY COUNCIL

DRAWING TITLE: EXISTING WEIR CONDITION AREA 3

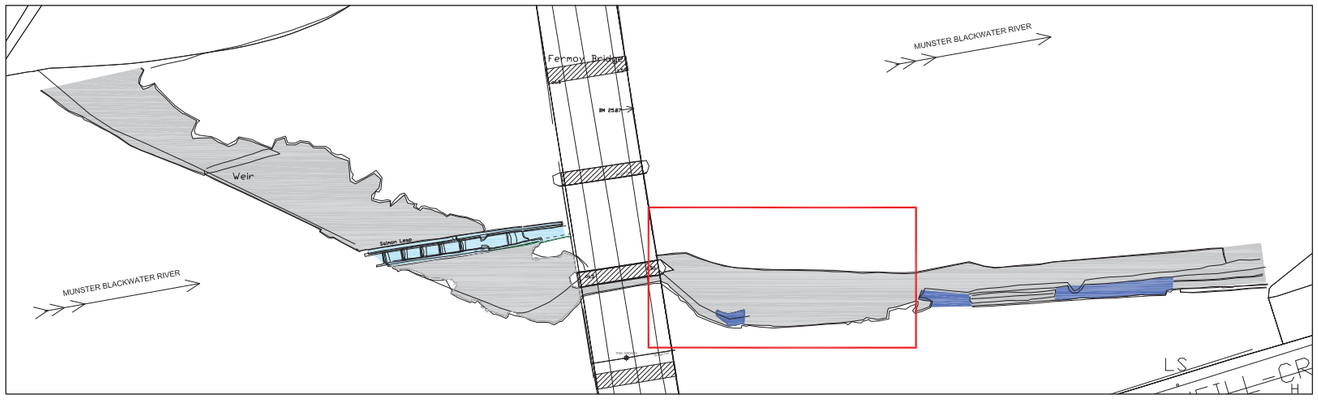
SCALE: 1:100 (A1)

PROJECT - ORIGINATOR - VOLUME - LOCATION - TYPE - ROLE - NUMBER
19011-TJOC-PL-XX-DR-C-0076

REV: C01

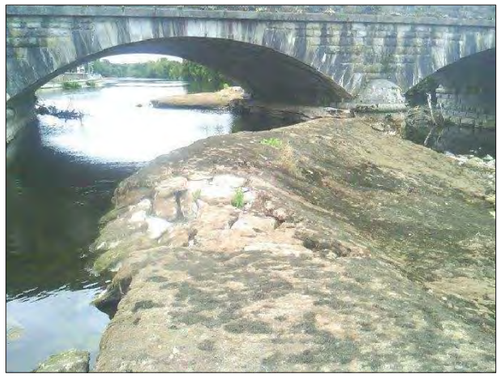


1/0077 EXISTING WEIR LAYOUT - AREA 4
SCALE: 1:100



2/0077 KEYPLAN - AREA 4
SCALE: 1:500

T/0077 LARGE VOIDS UNDER CONCRETE WEIR APRON, REINFORCEMENT EXPOSED AND CORRODED



U/0077 MINOR BREACH IN WEIR CREST

O/0077 SURFACE OF CONCRETE WEIR APRON HAS DISINTEGRATED IN PLACES

R/0077 LARGE VOIDS UNDER CONCRETE WEIR APRON

S/0077 REINFORCEMENT EXPOSED AND CORRODED UNDER WEIR APRON

NOTES:

1. COMMENTS AND PHOTOGRAPHS ON THE CONDITION OF THE WEIR ARE BASED ON A VISUAL INSPECTION OF THE WEIR ON 15th AUGUST 2018. NO OPENING UP WORKS OF ANY KIND WERE UNDERTAKEN DURING THE VISUAL INSPECTION.

REV	SUIT	DESCRIPTION	DATE
C01	AP	ISSUED FOR PLANNING	02.06.2022

DRAWING STATUS: ISSUED FOR PLANNING

CHECKED BY:	REVIEWED BY:	APPROVED BY:
LC	MV	DC

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CORRIG HOUSE, CORRIG ROAD, SANDYFORD, DUBLIN 18.
Tel: 01-295 2321 Fax: 01-295 4541 Email: tjoc@tjoc.ie Web: www.tjoc.ie

PROJECT: FERMOY WEIR REMEDIATION

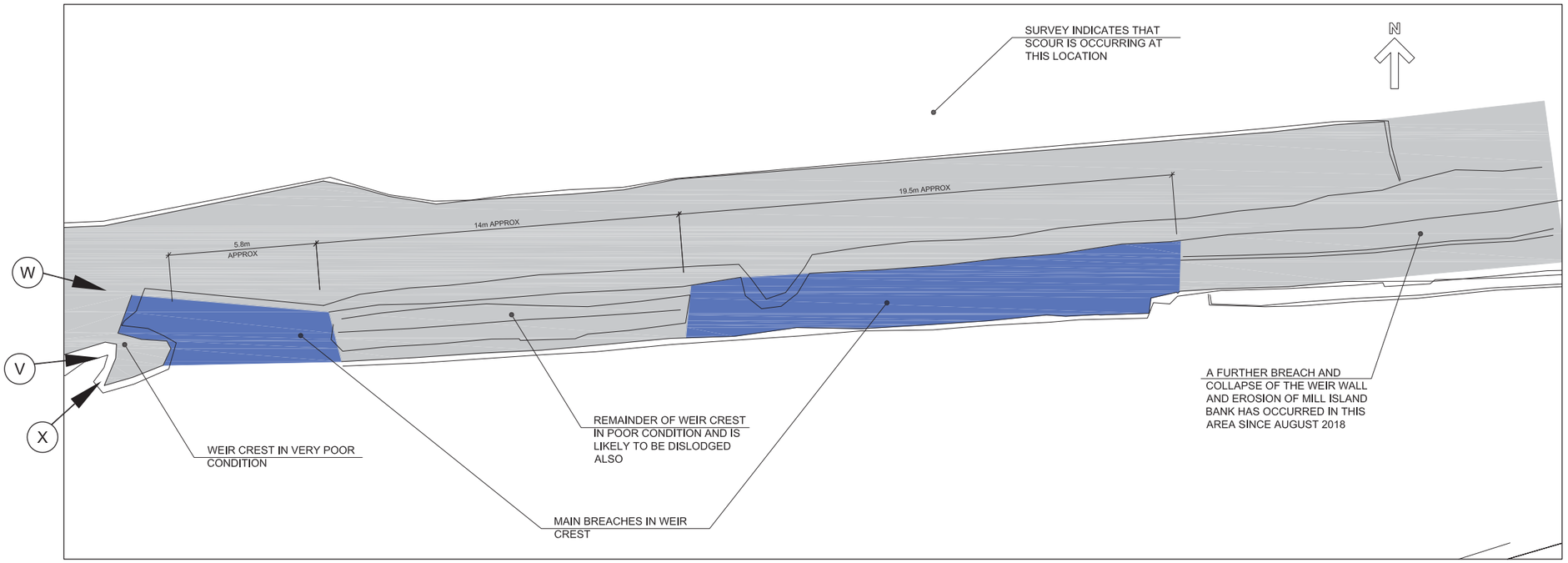
CLIENT: CORK COUNTY COUNCIL

DRAWING TITLE: EXISTING WEIR CONDITION AREA 4

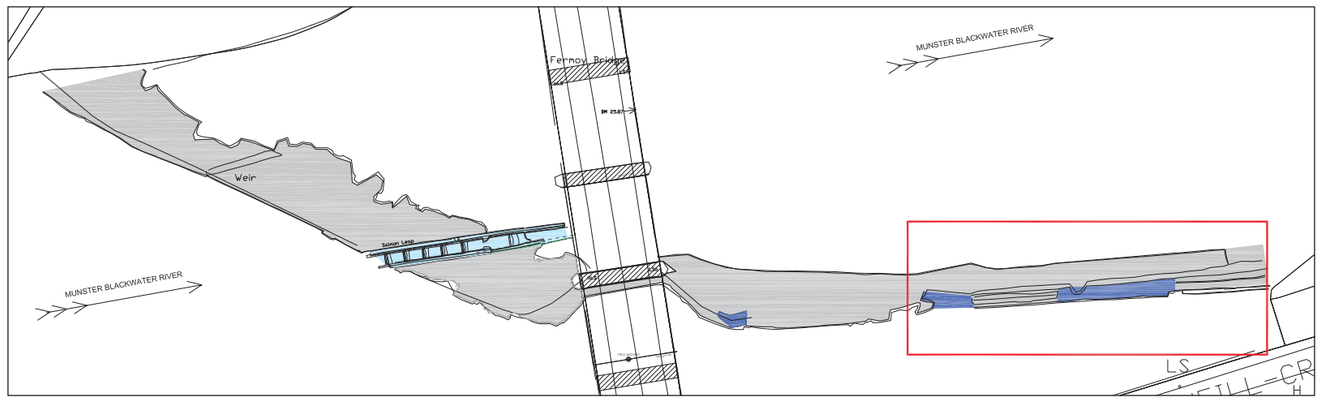
SCALE: 1:100 (A1)

PROJECT - ORIGINATOR - VOLUME -LOCATION- TYPE -ROLE- NUMBER
19011-TJOC-PL-XX-DR-C-0077

REV: C01



1/0078 EXISTING WEIR LAYOUT - AREA 5
SCALE: 1:100



2/0078 KEYPLAN - AREA 5
SCALE: 1:500

V/0078 VIEW OF WEIR CREST

W/0078 VIEW OF WEIR CREST AND DOWNSTREAM APRON

X/0078 VIEW OF WEIR CREST CONDITION

NOTES:

1. COMMENTS AND PHOTOGRAPHS ON THE CONDITION OF THE WEIR ARE BASED ON A VISUAL INSPECTION OF THE WEIR ON 15th AUGUST 2018. NO OPENING UP WORKS OF ANY KIND WERE UNDERTAKEN DURING THE VISUAL INSPECTION.

REV	SUIT	DESCRIPTION	DATE
C01	AP	ISSUED FOR PLANNING	02.06.2022

DRAWING STATUS: ISSUED FOR PLANNING

CHECKED BY:	REVIEWED BY:	APPROVED BY:
LC	MV	DC

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Tel: 01-295 2321 Fax: 01-295 4541 Email: tjoc@tjoc.ie Web: www.tjoc.ie

PROJECT: FERMOY WEIR REMEDIATION

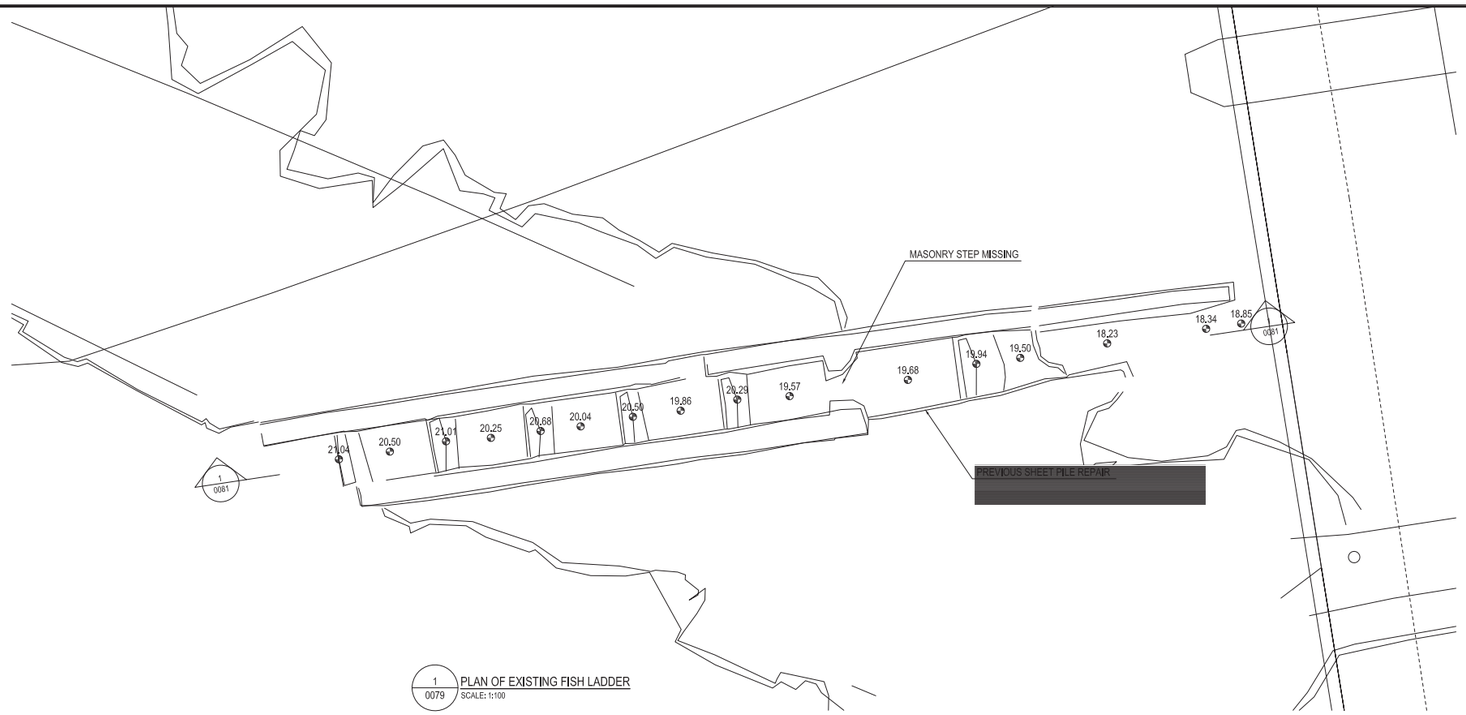
CLIENT: CORK COUNTY COUNCIL

DRAWING TITLE: EXISTING WEIR CONDITION AREA 5

SCALE: 1:100 (A1)

PROJECT - ORIGINATOR - VOLUME - LOCATION - TYPE - ROLE - NUMBER
19011-TJOC-PL-XX-DR-C-0078

REV: C01

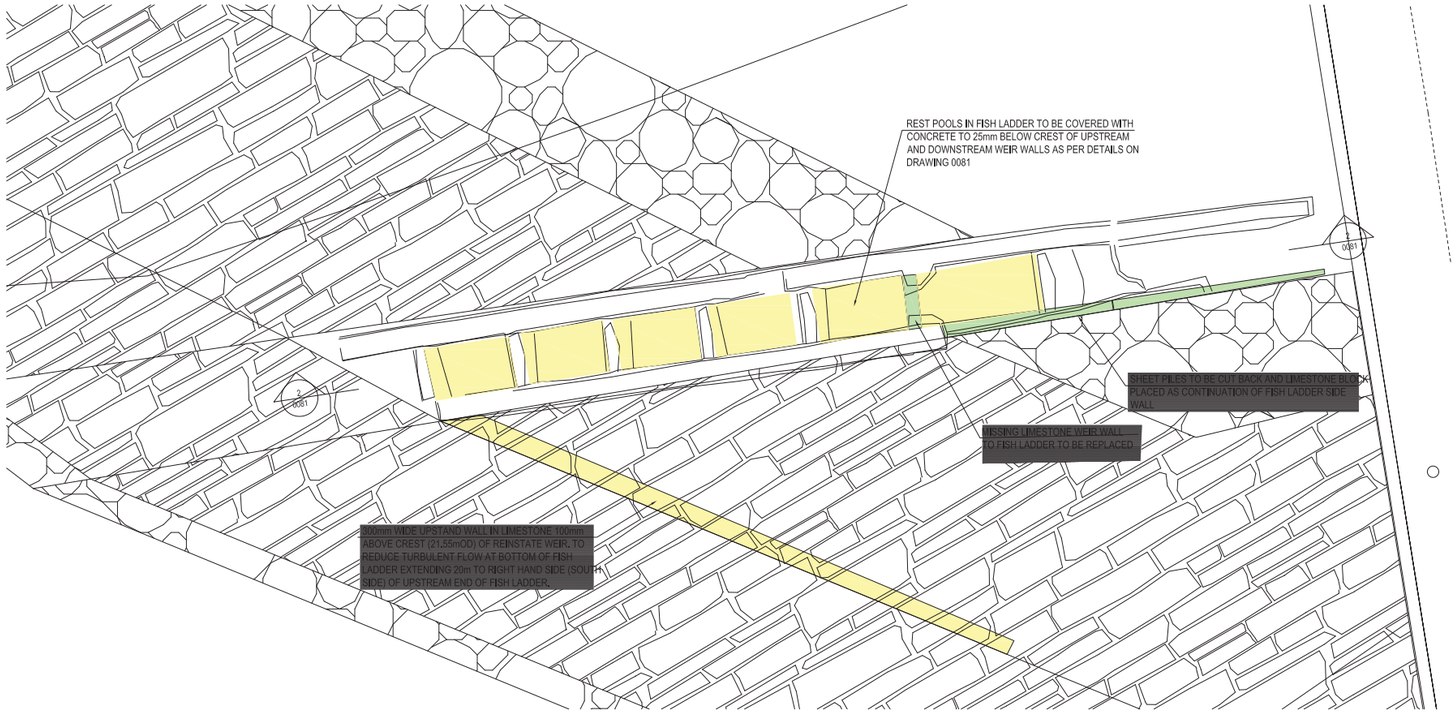


1 / 0079 PLAN OF EXISTING FISH LADDER
SCALE: 1:100

NOTES:

1. 1. FISH PASS REMEDIATION WORKS SHALL BE CARRIED OUT IN ACCORDANCE WITH CONSERVATION ENGINEER'S RECOMMENDATIONS AND DETAILS SHOWN ON DRAWING 0081.
2. LAYOUT OF EXISTING FISH LADDER BASED ON MURPHY SURVEYS TOPOGRAPHICAL SURVEY COMPLETED AUGUST 2018.

NOTE:
DETAILS AND DIMENSIONS OF PROPOSED WORKS TO FISH PASS ARE TAKEN FROM INFORMATION SUPPLIED BY OTHERS AND ARE SUBJECT TO APPROVAL FROM INLAND FISHERIES IRELAND



2 / 0079 PLAN OF PROPOSED WORKS TO EXISTING FISH LADDER
SCALE: 1:100

C01	AP	ISSUED FOR PLANNING	02.06.2022
REV	STAT	DESCRIPTION	DATE

DRAWING STATUS: ISSUED FOR PLANNING

CHECKED BY:	REVIEWED BY:	APPROVED BY:
LC	MV	DC

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Tel: 01-295 2321 Fax: 01-295 4541 Email: tjoc@tjoc.ie Web: www.tjoc.ie

PROJECT: FERMOY WEIR REMEDIATION AND FISH BYPASS CHANNEL

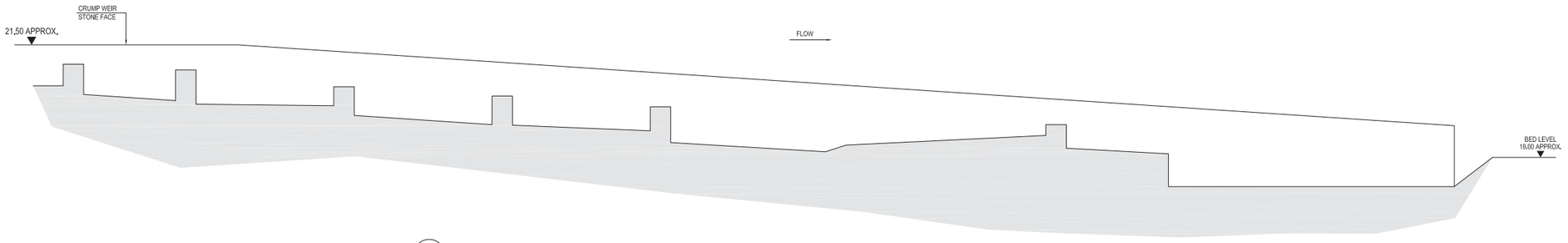
CLIENT: CORK COUNTY COUNCIL

DRAWING TITLE: EXISTING FISH LADDER REMEDIATION PLAN

SCALE: 1:100 (A1)

PROJECT - ORIGINATOR - VOLUME -LOCATION- TYPE -ROLE- NUMBER
19011-TJOC-PL-XX-DR-C-0079

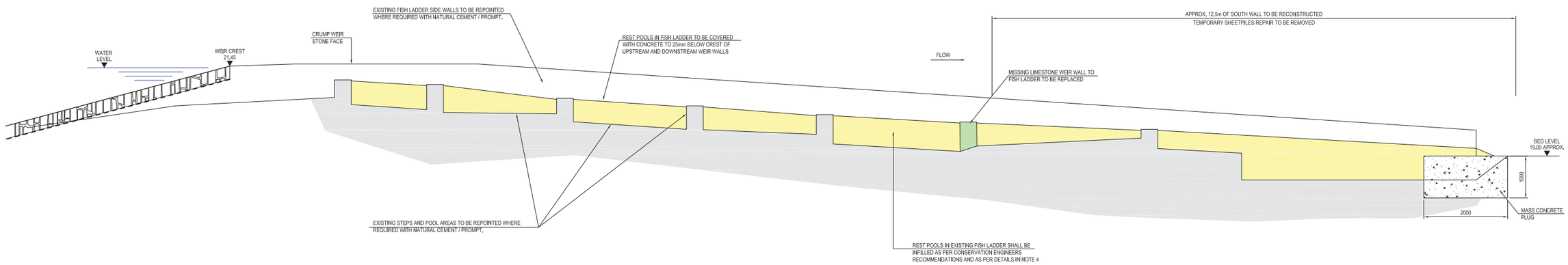
REV: C01



1 / 0081 EXISTING FISH LADDER SECTION
SCALE: 1:50

NOTES:

1. ALL WORKS CARRIED OUT IN THE RIVER AND TO THE FISH PASS TO BE AGREED WITH INLAND FISHERIES IRELAND PRIOR TO COMMENCEMENT OF THE WORKS.
2. WORKS IN THE RIVER WILL ONLY BE PERMITTED BETWEEN THE BEGINNING OF AUGUST TO MID SEPTEMBER IN ACCORDANCE WITH INLAND FISHERIES IRELAND GUIDELINES.
3. PROPOSED REMEDIAL WORK DETAILS AS PER CONSERVATION ENGINEER, TREVOR WOODS CONSULTING ENGINEERS, DETAILS.
4. COVERING
   DPM 1500 GAUGE TO BE LAID UP PASS INSIDE WALLS OVER BASE AND LAPPED MINIMUM 1m BETWEEN SHEETS / JOINTS.
   TYPE 6F FILL WITHIN 300mm EXISTING CAPPING.
   150mm CLAUSE 804 BLINDED WITH LEAN MIX CONCRETE.
   150mm CONCRETE SLAB (FIBRE MESH POLYPROPYLENE FIBRES)
   SURFACE TO BE STAMPED WITH RANDOM STONE PATTERN.
5. ALL LEVELS AS PER MURPHY SURVEYS 2018 SURVEY OF WEIR STRUCTURE.
6. EXISTING FISH LADDER SHALL BE INFILLED IN ORDER TO AVOID WHITE WATER CREATED BY THE STEPS IN THE LADDER ATTRACTING FISH FROM DOWNSTREAM OF THE WEIR.



2 / 0081 PROPOSED FISH LADDER SECTION
SCALE: 1:50

REV	STAT	DESCRIPTION	DATE
C01	AP	ISSUED FOR PLANNING	02.06.2022

DRAWING STATUS: ISSUED FOR PLANNING

CHECKED BY:	REVIEWED BY:	APPROVED BY:
LC	MV	DC

TJ O'CONNOR & ASSOCIATES
CONSULTING ENGINEERS
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Tel: 01-295 2321 Fax: 01-295 4541 Email: tjoc@tjoc.ie Web: www.tjoc.ie

PROJECT: FERMOY WEIR REMEDIATION AND FISH BYPASS CHANNEL

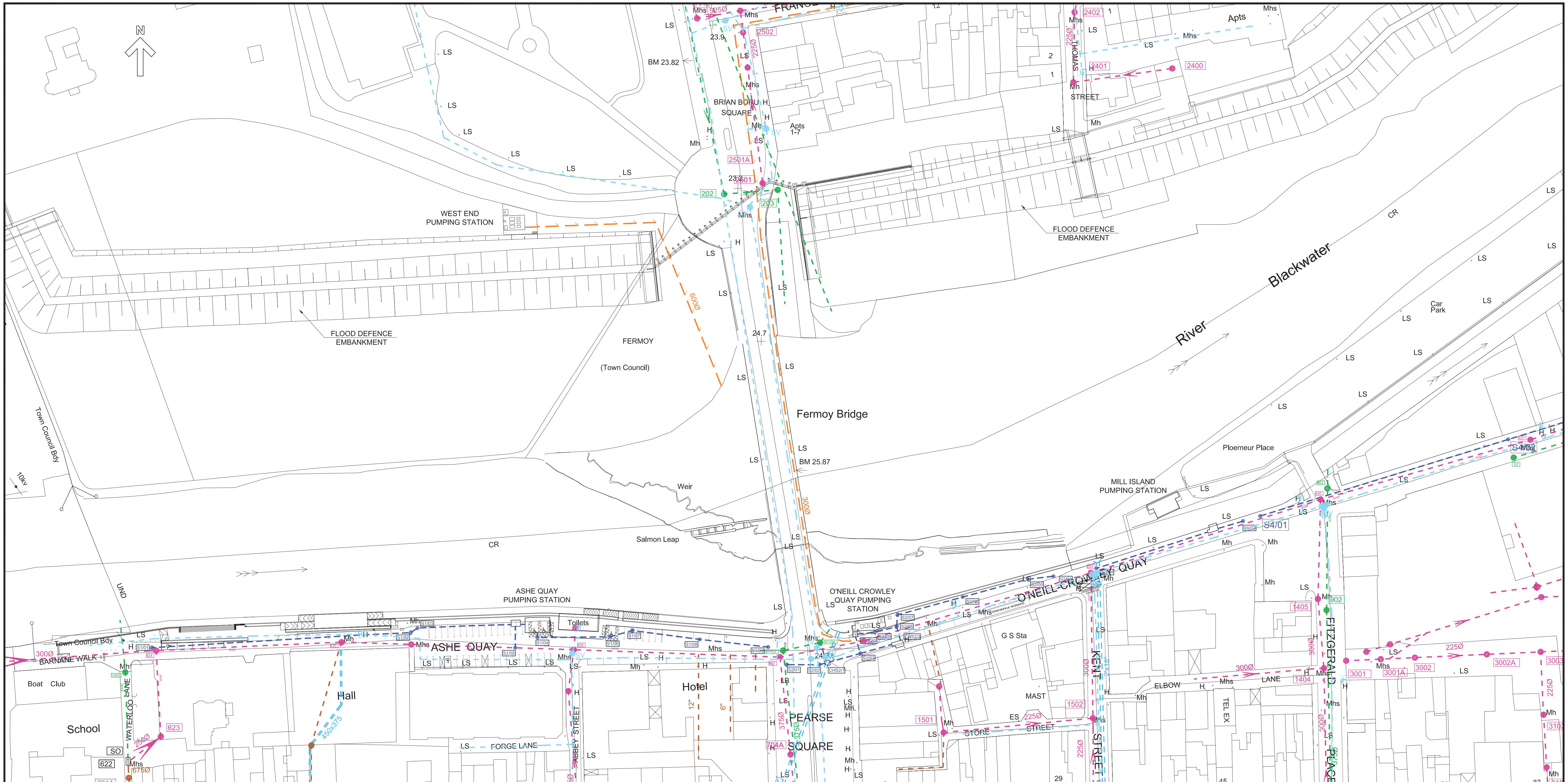
CLIENT: CORK COUNTY COUNCIL

DRAWING TITLE: EXISTING FISH LADDER REMEDIATION DETAILS - SHEET 2

SCALE: AS SHOWN (A1)

PROJECT - ORIGINATOR - VOLUME - LOCATION - TYPE - ROLE - NUMBER
190080-TJOC-PL-XX-DR-C-0081

REV: C01



0 7.5 15 22.5 30 45 60 75m
1:750

LEGEND

- FOUL SEWER
- SURFACE WATER SEWER
- COMBINED SEWER
- CULVERT SEWER
- RISING MAIN
- WATERMAIN

MAP REPRODUCED BY PERMISSION OF ORDNANCE SURVEY IRELAND (CORK CCMA 9802)

REV	STAT	DESCRIPTION	DATE
C01	AP	ISSUED FOR PLANNING	02.06.2022

DRAWING STATUS: ISSUED FOR REVIEW AND COMMENT

CHECKED BY: LC | REVIEWED BY: MV | APPROVED BY: DC

TJ O'CONNOR & ASSOCIATES
CONSULTING ENGINEERS
CORRIG HOUSE, CORRIG ROAD, SANDYFORD, DUBLIN 18.
Tel: 01-295 2321 Fax: 01-295 4541 Email: tjoc@tjoc.ie Web: www.tjoc.ie

PROJECT: FERMOY WEIR REMEDIATION AND FISH BYPASS CHANNEL

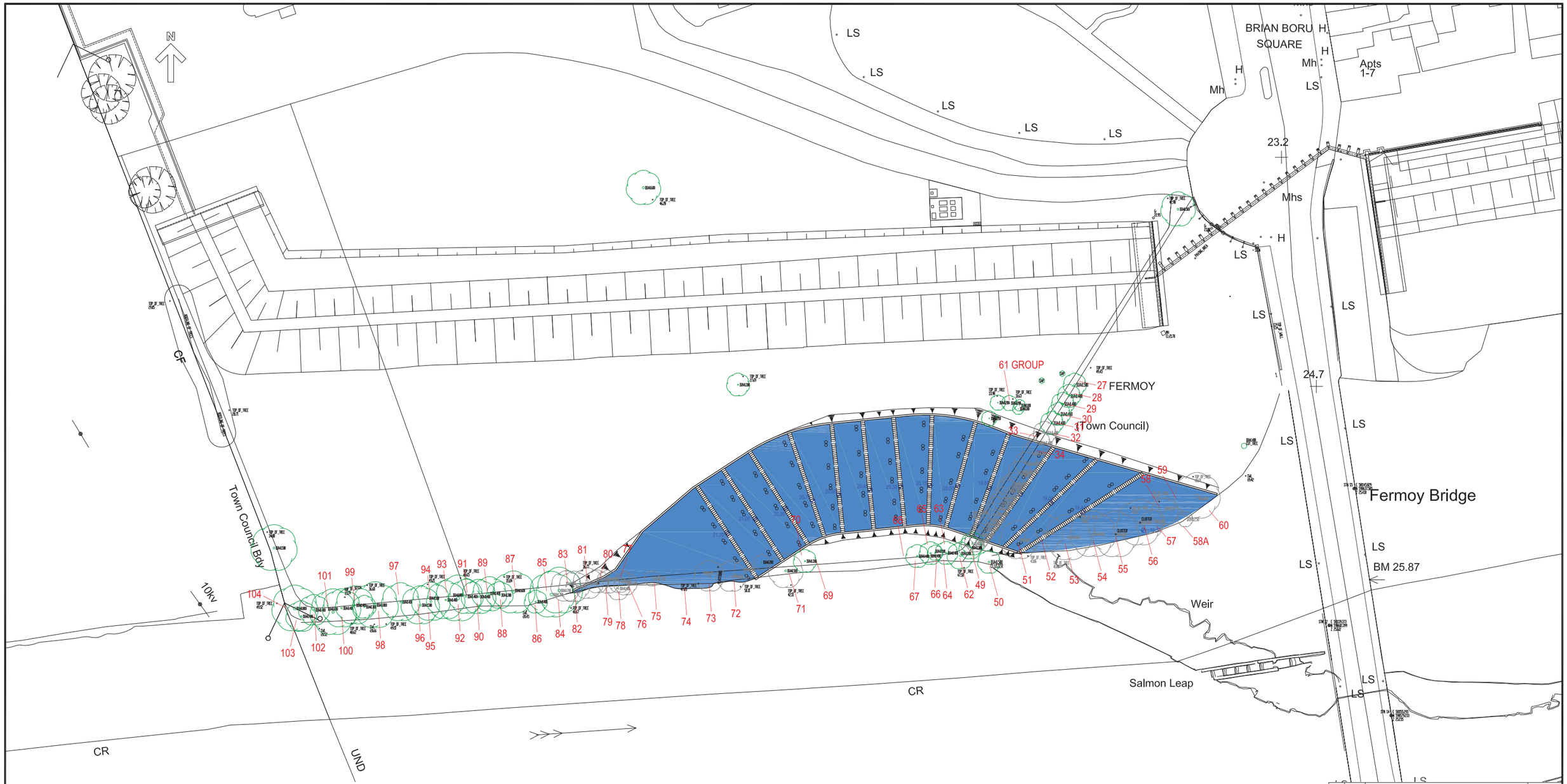
CLIENT: CORK COUNTY COUNCIL

DRAWING TITLE: EXISTING SERVICES

SCALE: 1:750 (A1)

PROJECT - ORIGINATOR - VOLUME - LOCATION - TYPE - ROLE - NUMBER
19011-TJOC-PL-XX-DR-C-0082

REV: P01



LEGEND:

EXISTING TREES

EXISTING TREES TO BE REMOVED

ROOT PROTECTION AREA

NOTES:

1. TREES LOCATIONS ARE BASED ON GEODATA 2020 TOPOGRAPHICAL SURVEY
2. DRAWING RECORDS TREES AND GROUPS OF TREES IDENTIFIED IN THE TREE SURVEY UNDERTAKEN BY MARK DONNELLY BSC ARBORIST IN 2021
3. TREE SURVEY DRAWING SHALL BE READ IN CONJUNCITON WITH THE ECOLOGISTS ECOLOGICAL IMPACT ASSESSMENT FOR THE PROJECT.

MAP REPRODUCED BY PERMISSION OF ORDNANCE SURVEY IRELAND (CORK CCMA 9802)

REV	STAT	DESCRIPTION	DATE
C01	AP	ISSUED FOR PLANNING	02.06.2022

DRAWING STATUS: ISSUED FOR PLANNING

CHECKED BY:	REVIEWED BY:	APPROVED BY:
LC	MV	DC

TJ O'CONNOR & ASSOCIATES
CONSULTING ENGINEERS
CORRIG HOUSE, CORRIG ROAD, SANDYFORD, DUBLIN 18.
Tel: 01-295 2321 Fax: 01-295 4541 Email: tjoc@tjoc.ie Web: www.tjoc.ie

PROJECT: FERMOY WEIR REMEDIATION AND FISH BYPASS CHANNEL

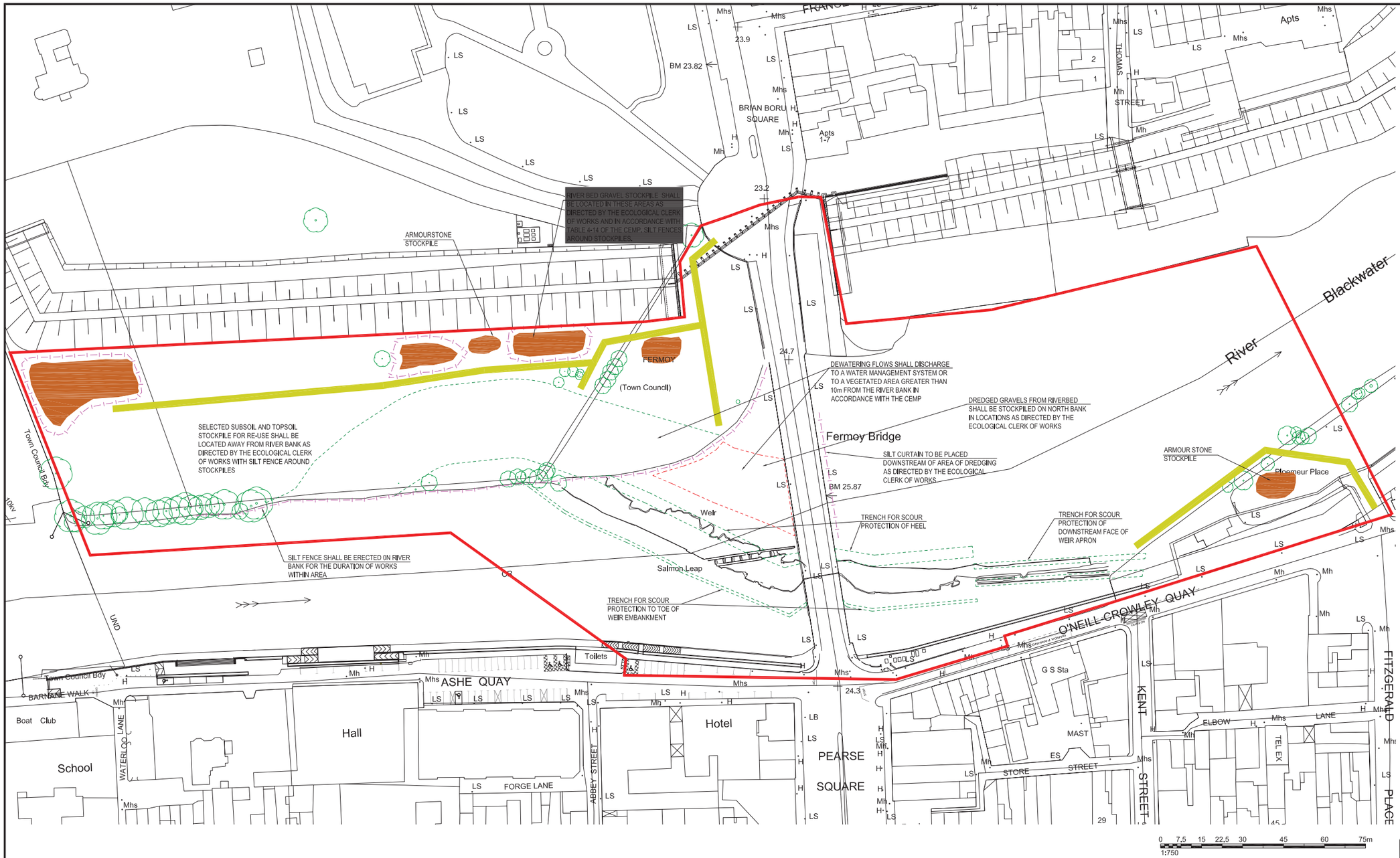
CLIENT: CORK COUNTY COUNCIL

DRAWING TITLE: TREE PROTECTION PLAN

SCALE: 1:500 (A1)

PROJECT - ORIGINATOR - VOLUME - LOCATION - TYPE - ROLE - NUMBER
19011-TJOC-PL-XX-DR-C-0083

REV: C01



0 7,5 15 22,5 30 45 60 75m
1:750

N

NOTES:

1. WHERE FEASIBLE SOIL EXCAVATION SHALL TAKE PLACE DURING DRY PERIODS AND UNDERTAKEN WITH EXCAVATORS AND DUMP TRUCKS.
2. TOP SOIL AND SUBSOIL SHALL NOT BE MIXED TOGETHER.
3. STOCKPILES SHALL BE GRADED TO <1:4 PROFILE. TOPSOIL AND SUBSOIL SHALL BE STOCKPILED SEPARATELY.
4. SURFACE WATER MANAGEMENT SHALL COMPLY WITH MITIGATION MEASURES IDENTIFIED IN TABLE 4-5 OF THE CEMP.
5. SILT FENCES SHALL BE ERECTED AROUND EACH STOCKPILE.
6. RIVERBED GRAVELS SELECTED FOR RE-USE IN THE WORKS SHALL BE STOCKPILED IN A BUNDED AREA AS DIRECTED BY THE ECOLOGICAL CLERK OF WORKS.
7. STOCKPILES SHALL NOT ENCROACH ON ROOT PROTECTION AREAS OF ANY TREES.
8. THE LOCATIONS OF STOCKPILES SHOWN HERE ARE INDICATIVE. THE CONTRACTOR SHALL DEVELOP MATERIALS STORAGE PROPOSALS IN ACCORDANCE WITH THE CEMP AND TO THE SATISFACTION OF THE ECOLOGICAL CLERK OF WORKS.
9. STOCKPILING OF MATERIALS SHALL NOT BE PERMITTED WITHIN THE MAIN CHANNEL OF THE BLACKWATER APART FROM LOCAL STOCKPILES OF MATERIAL REQUIRED FOR THE REMEDIATION OF THE WEIR.

LEGEND:

- PROPOSED SITE BOUNDARY
- OUTLINE OF PROPOSED EXCAVATION
- AREA OF DREDGING
- SILT FENCE
- EXISTING TREES TO BE RETAINED
- CONSTRUCTION ACCESS ROUTES

MAP REPRODUCED BY PERMISSION OF ORDNANCE SURVEY IRELAND (CORK CCMA 9802)

REV	STAT	DESCRIPTION	DATE
C01	AP	ISSUED FOR PLANNING	02.06.2022

DRAWING STATUS: ISSUED FOR PLANNING

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Tel: 01-295 2321 Fax: 01-295 4541 Email: tjoc@tjoc.ie Web: www.tjoc.ie

PROJECT: FERMOY WEIR REMEDIATION AND FISH BYPASS CHANNEL

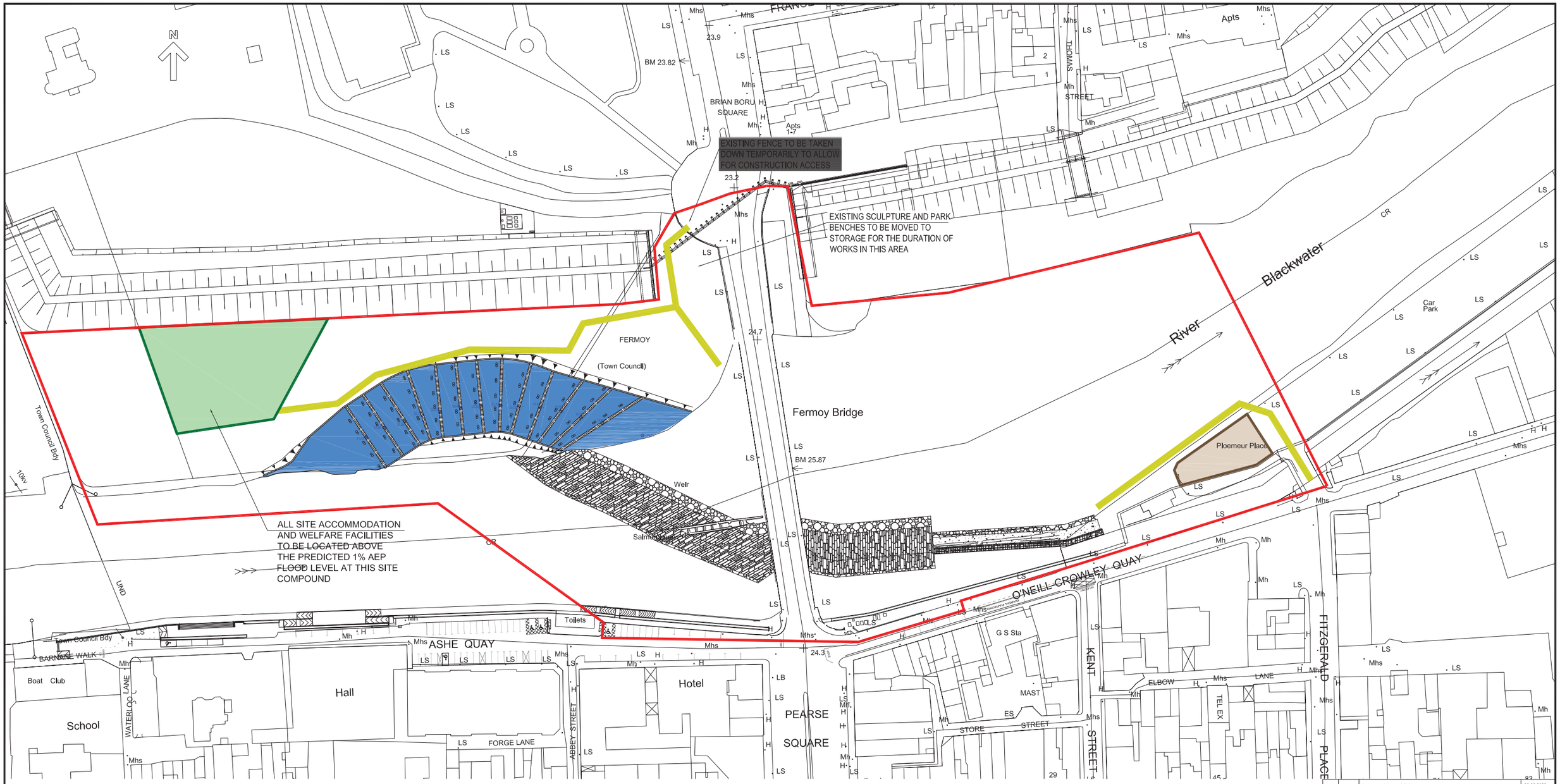
CLIENT: CORK COUNTY COUNCIL

DRAWING TITLE: CONSTRUCTION SPOIL MANAGEMENT

SCALE: 1:750 (A1)

PROJECT - ORIGINATOR - VOLUME -LOCATION- TYPE - ROLE - NUMBER
19011-TJOC-PL-XX-DR-C-0084

REV: C01



LEGEND:

- SITE COMPOUND
- SATELLITE COMPOUND
- SITE BOUNDARY
- CONSTRUCTION ACCESS ROUTES

MAP REPRODUCED BY PERMISSION OF ORDNANCE SURVEY IRELAND (CORK CCMA 9802)

REV	STAT	DESCRIPTION	DATE
C01	AP	ISSUED FOR PLANNING	02.06.2022

DRAWING STATUS: ISSUED FOR PLANNING

CHECKED BY:	REVIEWED BY:	APPROVED BY:
LC	MV	DC

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CONSULTING ENGINEERS
CORRIG HOUSE, CORRIG ROAD, SANDYFORD, DUBLIN 18.
Tel: 01-295 2321 Fax: 01-295 4541 Email: tjoc@tjoc.ie Web: www.tjoc.ie

PROJECT: FERMOY WEIR REMEDIATION AND FISH BYPASS CHANNEL

CLIENT: CORK COUNTY COUNCIL

DRAWING TITLE: SITE COMPOUNDS

SCALE: 1:750 (A1)

PROJECT - ORIGINATOR - VOLUME - LOCATION - TYPE - ROLE - NUMBER: 19011-TJOC-PL-XX-DR-C-0085

REV: C01

N

EXISTING FENCE TO BE TAKEN DOWN TEMPORARILY TO ALLOW FOR CONSTRUCTION ACCESS

EXISTING SCULPTURE AND PARK BENCHES TO BE MOVED TO STORAGE FOR THE DURATION OF WORKS IN THIS AREA

BRIAN BORU SQUARE

THOMAS STREET

Apts

FERMOY

(Town Council)

NORTH BANK ACCESS

BUND AND SILT FENCE DOWNSTREAM OF BRIDGE FOR DURATION OF STAGE 2 WORKS

Fermoy Bridge

River Blackwater

CR

Car Park

SOUTH BANK ACCESS FOR STAGE 3 WORKS

Ploemeur Place

TEMPORARY STONE ACCESS FOR STAGE 2 WORKS

BUND AND SILT FENCE AS DIRECTED BY THE ECOLOGICAL CLERK OF WORKS FOR DURATION OF STAGE 3 WORKS

BM 25.87

BM 23.82

Town Council Bdy

10kV

FISH BYPASS CHANNEL TO BE CONSTRUCTED OFF LINE FROM MAIN CHANNEL OF THE RIVER BLACKWATER IN STAGE 1. RIVER TIE IN WORKS TO BE COMPLETED IN PERIOD JULY - SEPT TO COMPLY WITH IFI GUIDELINES FOR INSTREAM WORKS AFTER STAGE 2 IS COMPLETE.

TEMPORARY SHEET PILE AND SAND BAG PROTECTION TO CREATE DRY WORKING AREA FOR DURATION OF STAGE 2

Weir

Inion Leas

O'NEILL CROWLEY QUAY

UND

Toilets

Town Council Bdy

BARRACK WALK

Boat Club

School

WATERLOO LANE

ASHE QUAY

Hall

CRANE POSITIONED IN CAR PARKING SPACES WHEN REQUIRED

TEMPORARY SHEET PILE AND SAND BAG PROTECTION TO CREATE DRY WORKING AREA FOR DURATION OF STAGE 3 WORKS DOWNSTREAM OF BRIDGE. ONLY TO BE PUT IN PLACE WHEN BYPASS CHANNEL TIE IN IS COMPLETE.

CRANE POSITIONED WHEN REQUIRED TO LIFT MATERIALS

FORGE LANE

ABBEY STREET

PEARSE SQUARE

G S Sta

MAST

STORE

ES

KENT STREET

ELBOW LANE

TEL EX

FITZGERALD PLACE

0 7.5 15 22.5 30 45 60 75m
1:750

NOTES

1. SEQUENCE OF CONSTRUCTION OPERATIONS SHALL BE AS AGREED WITH IFI AND SHALL BE IN COMPLIANCE WITH THE CEMP
2. INSTREAM WORKS SHALL BE UNDERTAKEN IN ACCORDANCE WITH FISHERIES IRELAND GUIDELINES FOR INSTREAM WORKS
3. STAGE 1 WORKS ON THE NORTH BANK OF THE RIVER TO CONSTRUCT THE FISH BYPASS CHANNEL SHALL PROCEED AS AN OFF LINE CONSTRUCTION. THE TIES INS OF THE FISH BYPASS CHANNEL TO THE RIVER SHALL BE COMPLETED AFTER THE STAGE 2 WORKS, TO REMEDIATE THE WEIR UPSTREAM OF FERMOY BRIDGE, ARE COMPLETE.
4. 4. STAGE 3 WORKS TO REMEDIATE THE WEIR DOWNSTREAM OF THE BRIDGE SHALL NOT COMMENCE PRIOR TO COMPLETION OF STAGE 2, WEIR REMEDIATION WORKS UPSTREAM OF THE BRIDGE, AND COMPLETION OF FISH BYPASS CHANNEL TIE INS TO RIVER BLACKWATER

LEGEND:

STAGE 1 - WORKS ON NORTH BANK OF RIVER FOR BYPASS CHANNEL

STAGE 2 - IN STREAM WORKS UPSTREAM OF BRIDGE

STAGE 3 - IN STREAM WORKS DOWNSTREAM OF BRIDGE

REV	STAT	DESCRIPTION	DATE
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LC	MV	DC

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PROJECT: FERMOY WEIR REMEDIATION AND FISH BYPASS CHANNEL

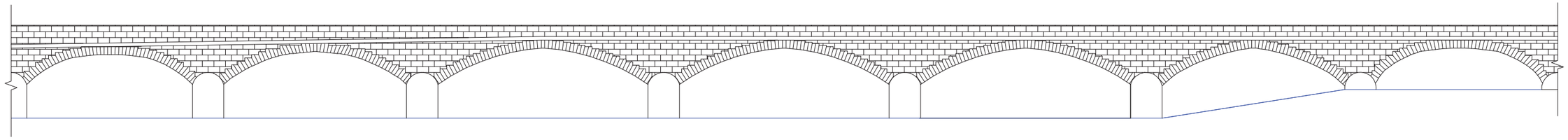
CLIENT: CORK COUNTY COUNCIL

DRAWING TITLE: INSTREAM WORKS PHASING

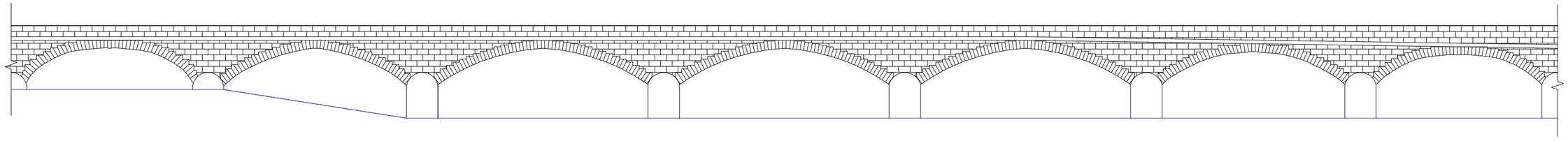
SCALE: 1:750 (A1)

PROJECT - ORIGINATOR - VOLUME - LOCATION - TYPE - ROLE - NUMBER
19011-TJOC-PL-XX-DR-C-0086

REV: C01



1 / 0087 EAST ELEVATION
SCALE: 1:150



2 / 0087 WEST ELEVATION
SCALE: 1:150

REV	SUIT	DESCRIPTION	DATE
C01	AP	ISSUED FOR PLANNING	02.06.2022

DRAWING STATUS: ISSUED FOR PLANNING

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Tel: 01-295 2321 Fax: 01-295 4541 Email: tjoc@tjoc.ie Web: www.tjoc.ie

PROJECT: FERMOY WEIR REMEDIATION

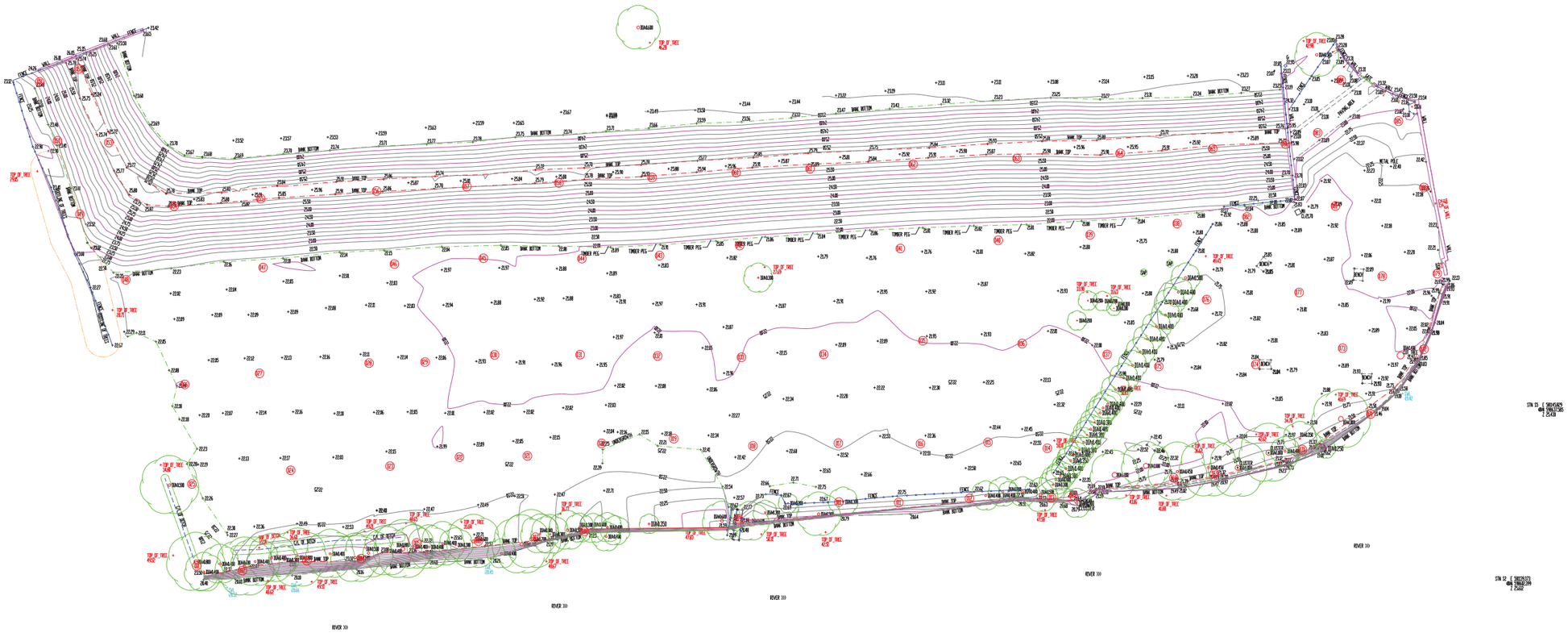
CLIENT: CORK COUNTY COUNCIL

DRAWING TITLE: FERMOY BRIDGE ELEVATIONS

SCALE: 1:150 (A1)

PROJECT - ORIGINATOR - VOLUME -LOCATION- TYPE - ROLE - NUMBER
19011-TJOC-PL-XX-DR-C-0087

REV: C01



Topographical Survey
Scale 1:500

ITM NORTH

SURVEY NOTES
1. ALL LEVELS ARE RELATED TO MALIN HEAD DATUM (OSGM15)
2. ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE STATED.
3. ANY DESCRIPENCIES IN THE SURVEY SHOULD BE REPORED TO GEODATA SURVEYING LTD IMMEDIATELY.
4. DO NOT SCALE, THIS SHALL ONLY BE PERMITTED IN DIGITAL FORM.
5. GRID IS 20m X 20m

0 10m 20m 30m
1:500

SYMBOLS

+0.00	SPOT LEVEL	GY	GULLY	AV	AIR VALVE	AJ	ARMSTRONG JUNCTION		GATE	O/H ESB	OVERHEAD ESB LINE	SIGN	SIGN	UB	SOFFIT BEAM	+RIDGE	RIDGE LEVEL		FOUL SEWER		UNIDENTIFIED EM SIGNAL		TRAFFIC
	CONTROL SURVEY STATION	WM	WATER METER		FIRE HYDRANT	LP	LAMP POST	SW1.00	SURFACE WATER LEVEL	O/H TEL	OVERHEAD TEL LINE	8m	TREE ACTUAL SPREAD	SC CL	SOFFIT CEILING	+EAVES	SOFFIT LEVEL		STORM SEWER		ELECTRICAL CABLE		TRENCH
MH CL	MANHOLE COVER	SV	SLUICE VALVE	TEL	TEL INSP CHAMBER	TP	TELECOM POLE	+BL0.00	BED LEVEL WATERCOURSE	TL	TELECOM POLE	000	TREE TAG NO.	HEAD	HEAD TO FFL	FFL0.00	FINISH FLOOR LEVEL		COMBINED SEWER		PUBLIC LIGHTING		COMBINED SEWER
UL	UTILITY INSP CHAMBER	SC	STOP COCK	MP	MINI PILLAR	EP	ESB POLE	+IL	INVERT LEVEL	+TOP	TOP TAG	BL	BOLLARD	WB	WINDOW BOARD TO FFL	+200	PEG REF NUMBER	ESB	ESB BOX		UNIDENTIFIED GPR	ESB	ESB BOX

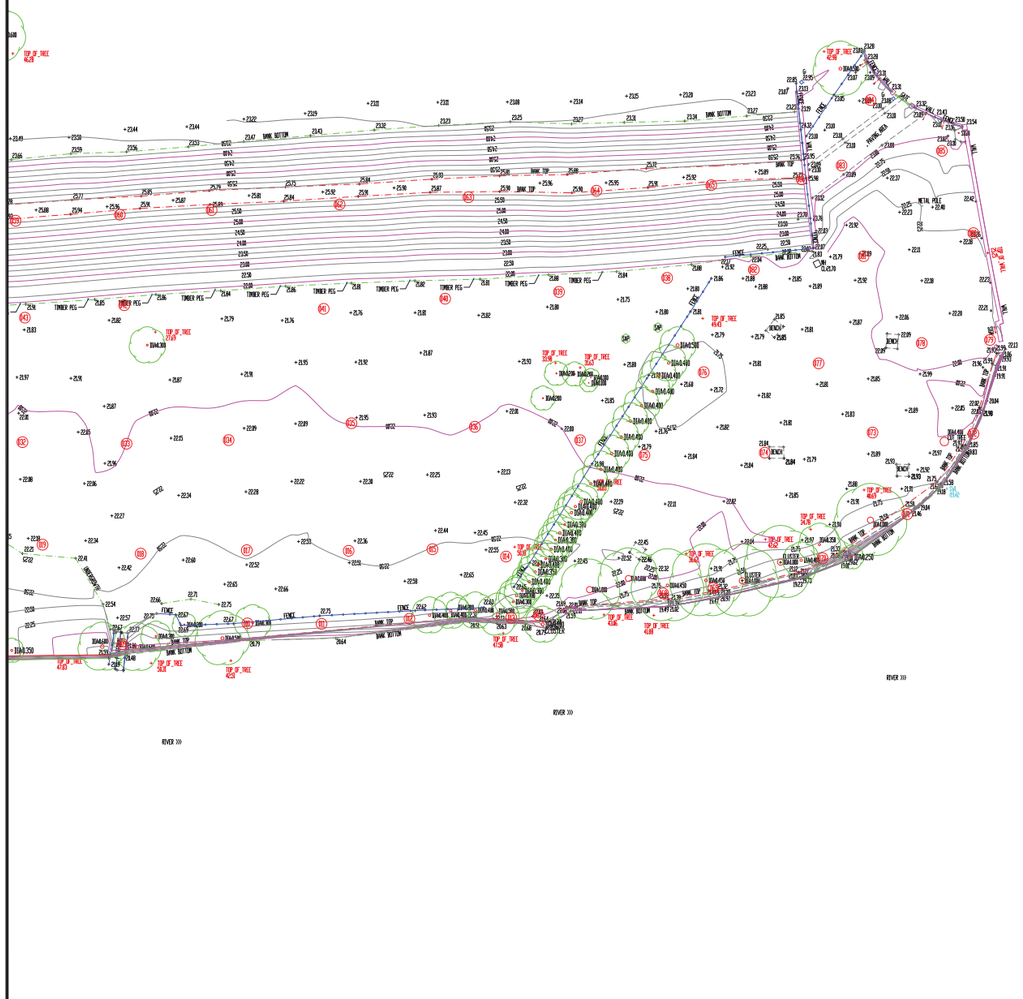
COORDINATE SYSTEM
ITM-Irish Transverse Mercator

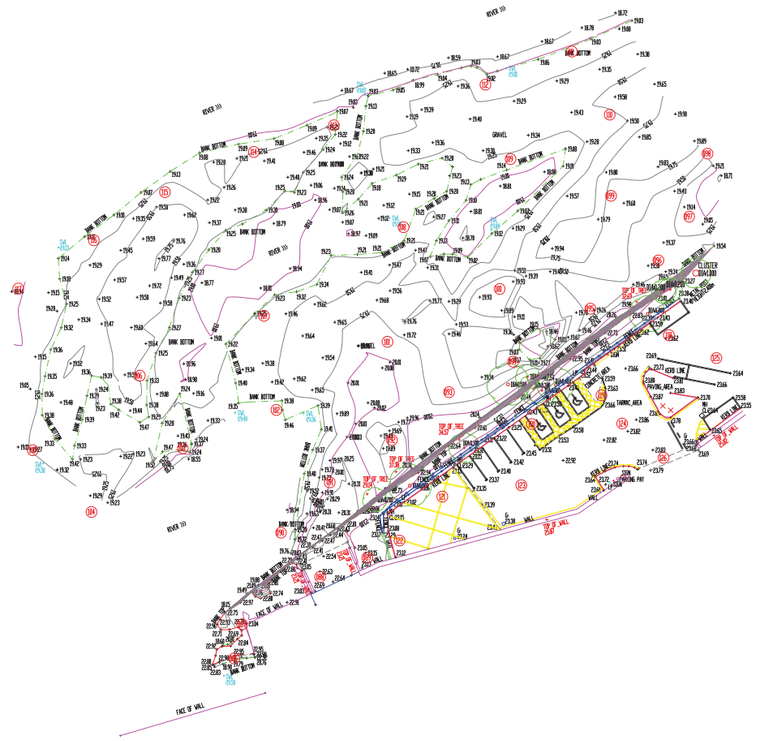
KEY PLAN

REVISION	DATE	DESCRIPTION	DRN BY	CKD BY
02	04-06-20	PHOTOS AND TREES	ML	KOB
01	24-05-20	TOPOGRAPHICAL SURVEY	ML	KOB

Geodata
Chartered Land Surveyors
47 Oliver Plunkett Street Bandon, Co Cork. P72 A443
Phone: (+353) (0)23 8852798 Fax: (+353) (0)23 8852799
Email: info@geodatasurveying.ie Website: www.geodatasurveying.ie

Client: TJ O'Connor 7 Associates
Project: Fermoy, Co Cork.
Title: Topographical Survey 2D
Scale: 1-500
Dwg. No: 20423-101
Date: 04-06-20
Sheet: A1





Topographical Survey
Scale 1:500

ITM NORTH

SURVEY NOTES
1. ALL LEVELS ARE RELATED TO MALIN HEAD DATUM (OSGM15)
2. ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE STATED.
3. ANY DESCRIPENCIES IN THE SURVEY SHOULD BE REPORED TO GEODATA SURVEYING LTD IMMEDIATELY.
4. DO NOT SCALE, THIS SHALL ONLY BE PERMITTED IN DIGITAL FORM.
5. GRID IS 20m X 20m

0 10m 20m 30m
1:500

SYMBOLS

+EL	SPOT LEVEL	G	GULLY	AV	AIR VALVE	AJ	ARMSTRONG JUNCTION		GATE	O/H ESB	OVERHEAD ESB LINE	SIGN	SIGN	UB	SOFFIT BEAM	+RIDGE	RIDGE LEVEL		FOUL SEWER		UNIDENTIFIED EM SIGNAL		TRAFFIC
	CONTROL SURVEY STATION	WM	WATER METER		FIRE HYDRANT	LP	LAMP POST	SWL0.00	SURFACE WATER LEVEL	O/H TEL	OVERHEAD TEL LINE	DIA = 10m	TREE ACTUAL SPREAD	SC CL	SOFFIT CEILING	+EAVES	SOFFIT LEVEL		STORM SEWER		ELECTRICAL CABLE		TRENCH
MH CL	MANHOLE COVER	SV	SLUICE VALVE	TEL	TEL INSP CHAMBER	TP	TELECOM POLE	+BL0.00	BED LEVEL WATERCOURSE	TL	TELECOM POLE	000	TREE TAG NO.	HEAD	HEAD TO FFL	FFL0.00	FINISH FLOOR LEVEL		COMBINED SEWER		PUBLIC LIGHTING		COMBINED SEWER
UL	UTILITY INSP CHAMBER	SC	STOP COCK	MP	MINE PILLAR	EP	ESB POLE	+IL	INVERT LEVEL	+TOP	TOP TAG	BL	BOLLARD	WB	WINDOW BOARD TO FFL	+200	PEG REF NUMBER	ESB	ESB BOX		UNIDENTIFIED GPR	ESB	ESB BOX

COORDINATE SYSTEM
ITM-Irish Transverse Mercator

KEY PLAN

REVISION	DATE	DESCRIPTION	DRN BY	CKD BY
01	24-05-20	TOPOGRAPHICAL SURVEY	AL	KDB

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Email: info@geodatasurveying.ie Website: www.geodatasurveying.ie

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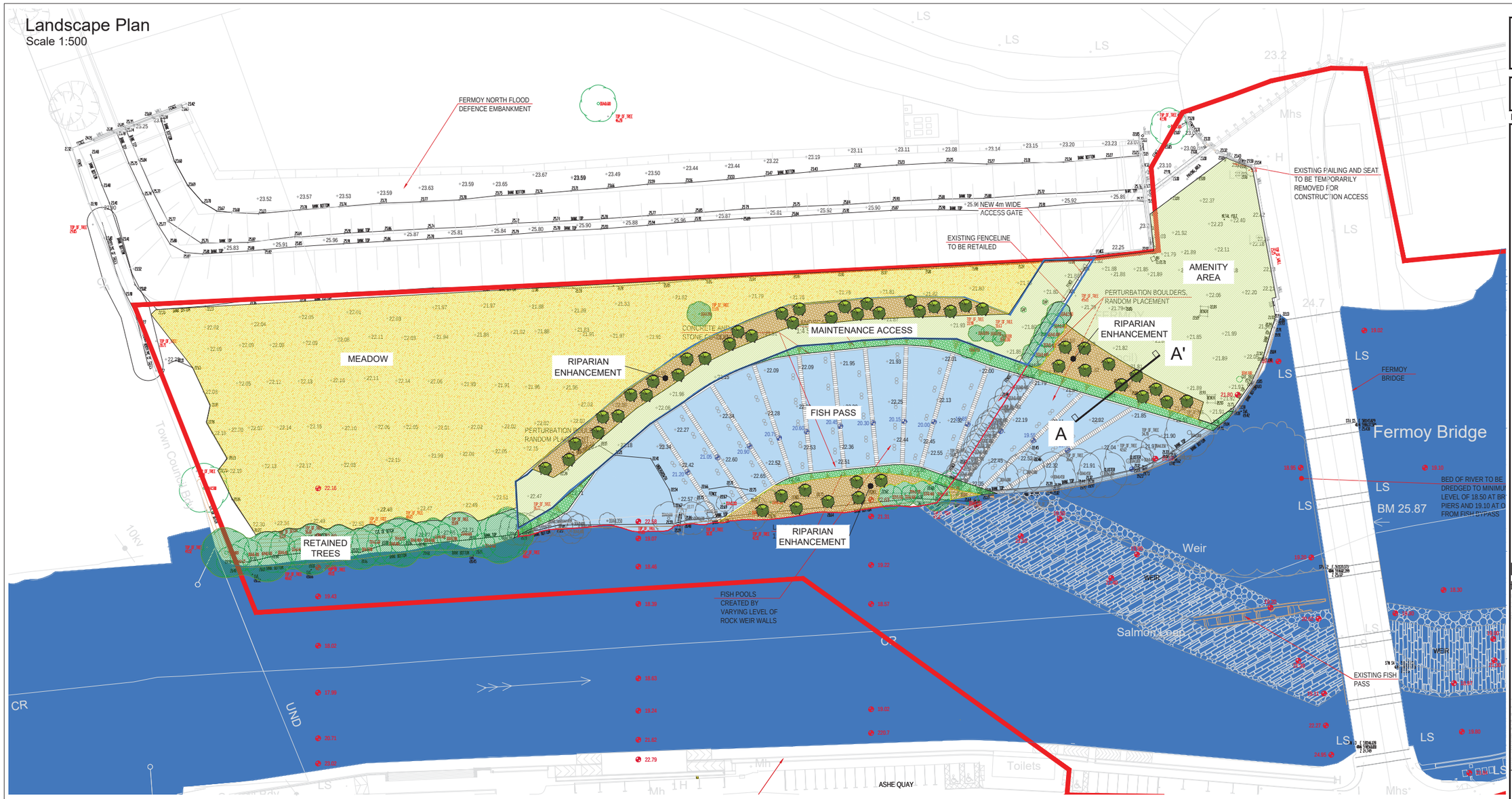
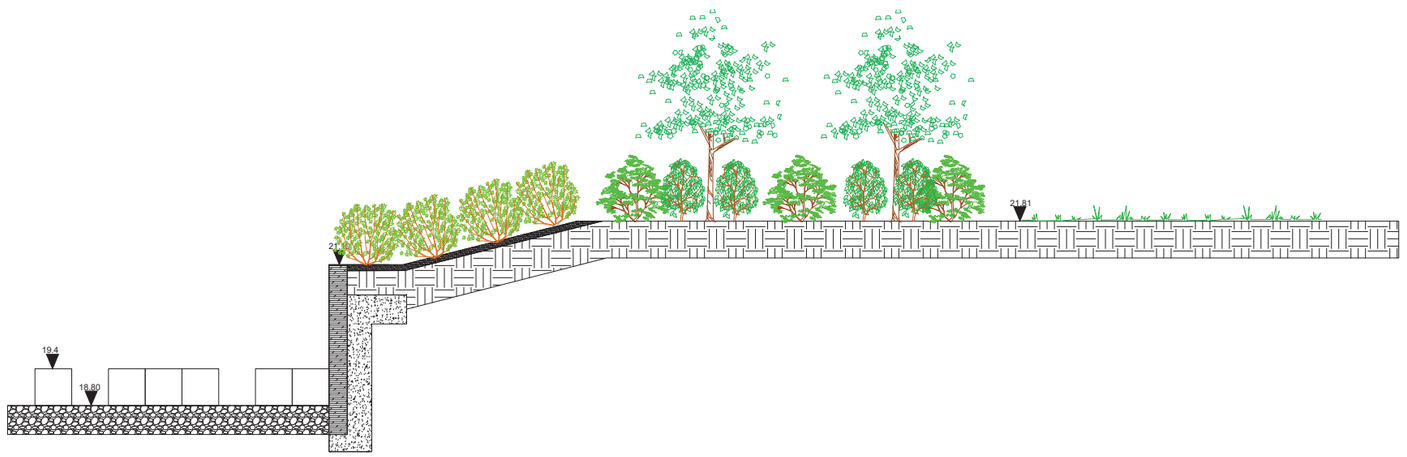
Project: Fermoy, Co Cork.
Title: Topographical Survey 2D
Scale: 1-500
Dwg. No: 20423-101
Date: 28-05-20
Sheet: A1

Landscape Plan
Scale 1:500



Section A-A'
Scale 1:50



doyle + otroithigh landscape architecture ltd.

North.

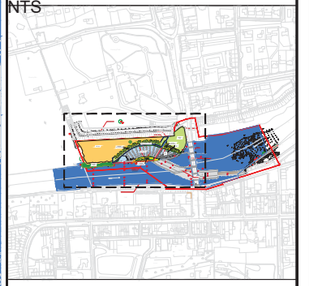
Note:

Legend

Legend:

- Trees
  A mixture of native species are proposed including Alder, Willow, Scots Pine, Birch & Rowan - 12-14cms
- Existing retained trees protected during the site works
- Willow peg plants (locally sourced) set into bank beside fish pass
- **Native Species Riparian Enhancement**
  15% Alder - 8-10 cms Trees / 80-100cms Transplants
  15% Salix 8-10 cms Trees / 80-100cms Transplants
  10% Wild Cherry 8-10cms Trees / 80-100cms Transplants
  10% Bird Cherry 8.10cms Trees / 80-100cms Transplants
  10% Native Black Poplar 80-100cms Transplants.
  15% Holly 40-60Cms Transplants
  15% Blackthorn 90-120 Cms Transplants
  2.5% Bramble - 40-60cms Transplants
  2.5% Hazel - 60-90Cms Transplants
  2.5% Dog Rose - 60-90Cms Transplants
  2.5% Spindle - 90-120 Cms Transplants
- Grass Meadow
- Hardwearing dwarf amenity ryegrass for public access

Keyplan
NTS



Date	Note

Project name: FERMOY FISH PASS	Project number: 21-053
Drawing name: LANDSCAPE PLAN	Drawing number: LP-01-PP

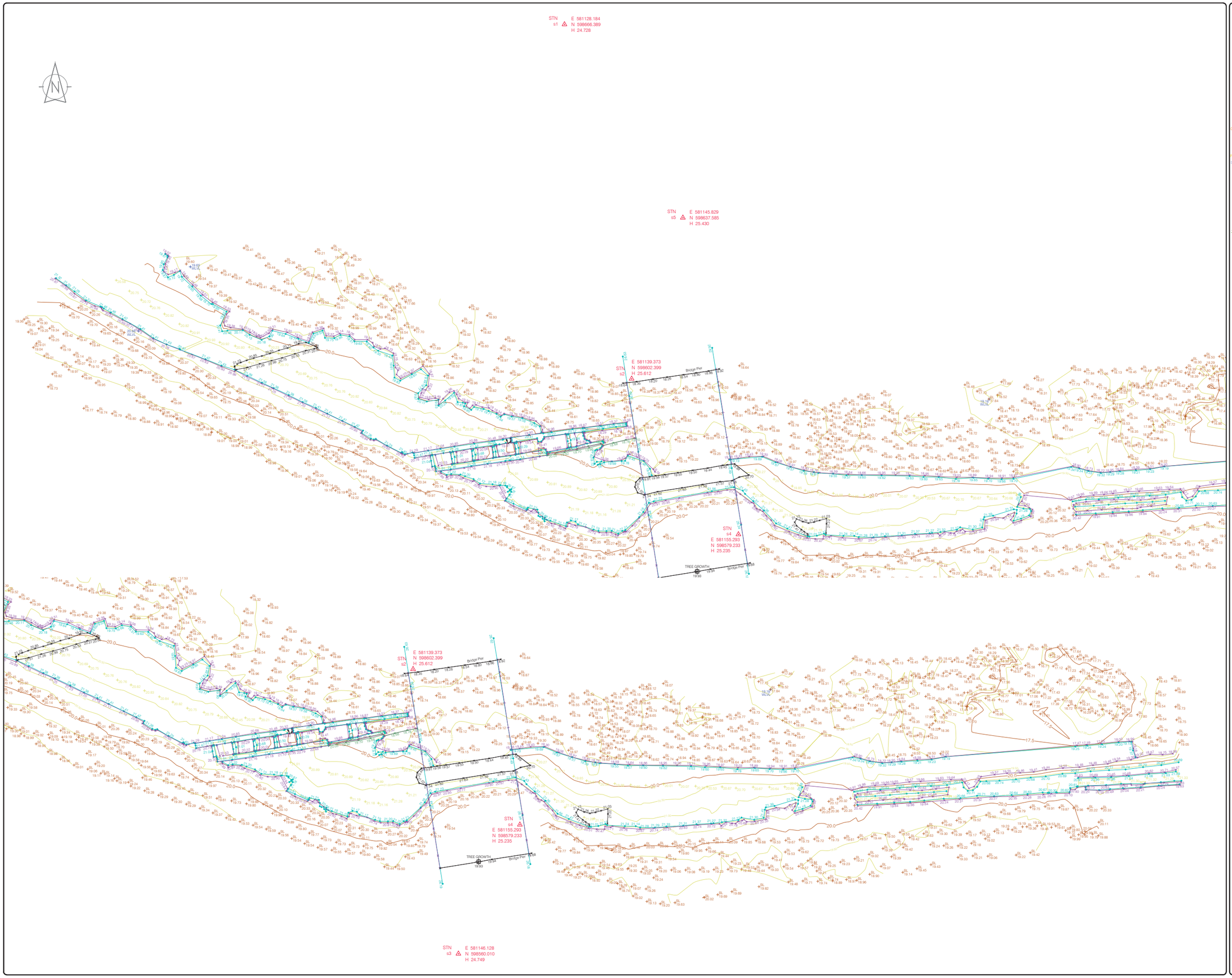
Drawing scale @ A1: 1:500 & 1:50	Drawn by: dos	Checked by: dot
Status: Planning		date: 04.04.2022

Contact details:
Linda Doyle (Director) mobile: 087 267 4196
e-mail: linda@doyle-otroithigh.com
Daithi o'Troithigh (Director) mobile: 086 300 3499
e-mail: daithi@doyle-otroithigh.com

Office address:
Pembroke House
28-32 Upper Pembroke Street
Dublin 2

doyle + o'troithigh
landscape - architecture

www.doyle-otroithigh.com



LEGEND

Street furniture & Services

- Over Head Wires (LUAS) - Pylon ESB
- Flowerbed
- Pipe
- Lift
- Barrier
- Pump
- Trial Pit
- Bus/Train Shelter
- Postbox
- Valve - General
- Water Valve
- Gas Valve
- Sluice Valve
- Air Valve
- Stop Cock
- C P Post
- Marker Post
- Traffic light
- Parking Meter
- Plane Aerial Mark
- Smart Card Validator
- Unknown Valve
- Road Sign
- Bus Stop
- Bollard
- Beacon
- Coalhole Cover
- Bore Hole
- Electricity Pole
- Telegraph pole
- OCS Pole
- CCTV Camera Pole
- Lamp Post
- Foul Manhole
- Surface Water MH
- Manholes
- Air Conditioning Vents
- Services Inspection Cover
- Traffic Inspection Cover
- Cable TV Inspection Cover
- ESAT Inspection Cover
- NTL Inspection Cover
- Eircom Inspection Cover
- Rodding Eye
- Phone Box
- Bench Seat
- Kiosk
- Gully
- Waste Bin
- Hydrant
- Fire Hydrant
- ESB Box
- ESB Inspection Cover
- Traffic Control Box
- LUAS Technical Cubicle
- Ticket Vending Machine
- Water Meter Cover
- Telecom Inspection Cover
- Monument / Toilets
- Tank Storage
- Basement: MH, Cover & Pipe
- Dished Aerial Mark
- Stay for pole
- Pipe Protection
- Washout

Natural Features

- Surface Change
- Land Drain
- Bottom of Slope
- Top of Slope
- Ditch
- Water Edge / Lake / Pond
- Hedge / Trees Drip Line / Vegetation
- Tree Coniferous
- Water Level
- Crown Level
- Invert level
- Bed Level
- Spotheight
- Top of Tree
- Tree Deciduous

Golf

- Fair Way
- Green
- Tee Box

Other

- Survey Station
- Photo point
- River Alignment

Built Features

Roads & Road Markings

- Building
- Edge of Road
- Kerb Bottom
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- Bridge Abutment
- Bridge Deck
- Bridge Parapet
- Building Façade
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- Hoarding
- Property Line
- Road Scar
- Top of Fence
- Floor Level
- Apex Height
- Eaves Height
- Parapet Height
- Soffit Elevation
- Step Level
- Concrete Pad
- Track
- Footpath / Platform Train & Tram
- Damp Proof Course / Verge
- Bridge Pier / Wall & Gate Pillar / LUAS Trackbed
- Cycleway / Private Landing Area
- Wall / Retaining Wall
- Railway / Tram Rail / Grating / Ramp
- Building Canopy / Roof / Overhang

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Site Location:

Map Sheet Layout:

Surveyed by : MSL	Date: Aug 2018
Drawn by : BK	Date: Aug 2018
Checked by : KC	Date: Aug 2018

Datum: Malin Head
Grid System: Irish National Grid ☐ ITM ■

Revisions

No.	Date	Description
1	29.08.18	Final Drawing

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Topographic surveys, Measured Building Surveys, Setting-Out, As-Built Surveys, Hydrographic Surveys, Legal Mapping, Pipeline Surveys, Services Location, Ground Penetrating Radar, Laser Scanning, Rectified Photography

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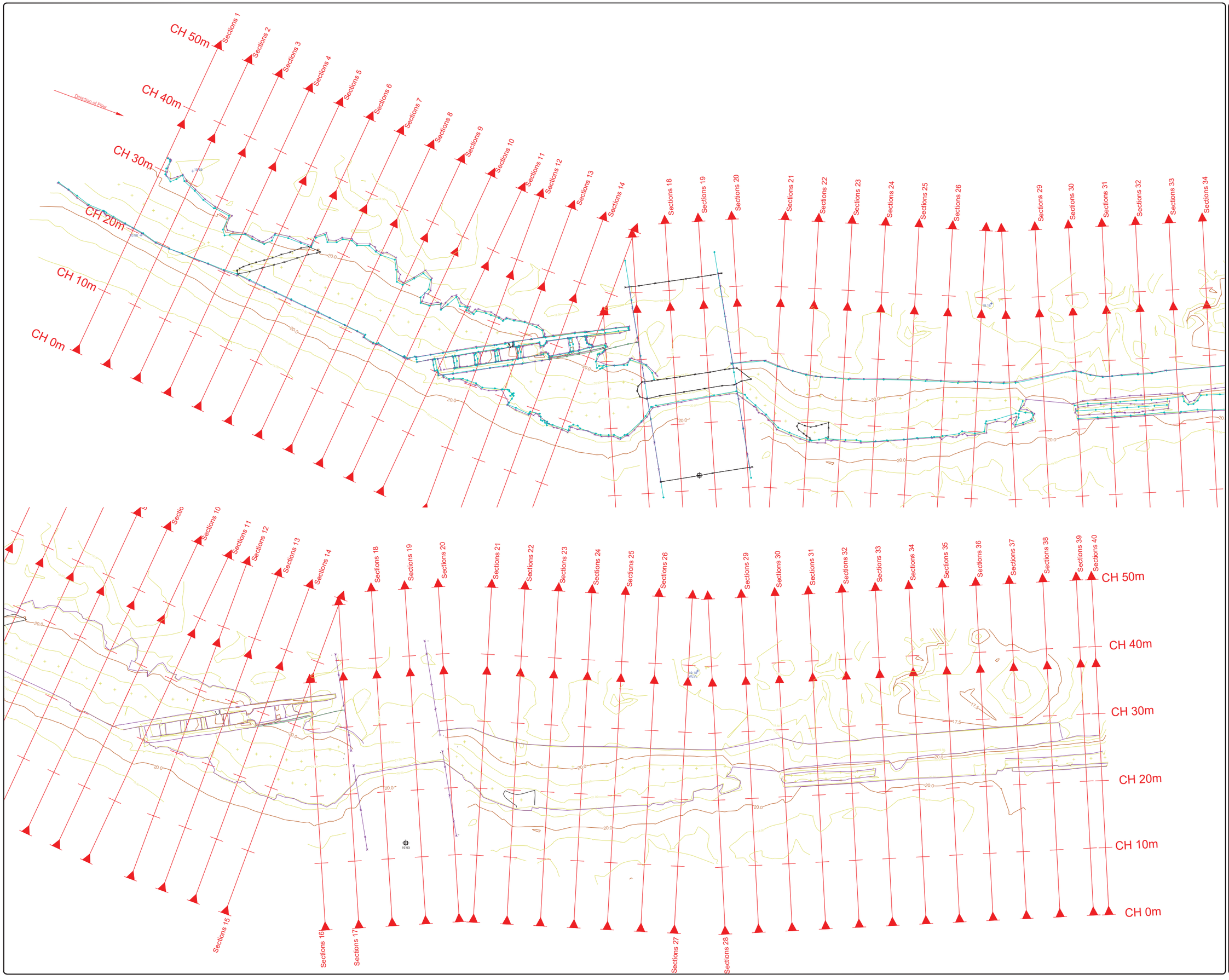
Ireland

Phone: (+353) 045 484040
Fax: (+353) 045 484004
Email: info@murphysurveys.ie

Client :	TJ_O'Connor_&_Associates
Project :	27232 18024_Fermoy_Weir
Date : 28.08.18	**Scale :** 1:250@A1
Description :	Topographical Survey
Drawing Number :	**FERMOY WEIR_PLAN**



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- Beacon
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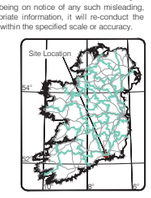

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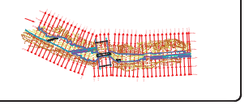

Surveyed by : MSL	Date: Aug 2018	Datum:	Malin Head
Drawn by : BK	Date: Aug 2018	Grid System:	
Checked by : KC	Date: Aug 2018	Irish National Grid ☐ ITM ■	

Revisions

No.	Date	Description
0	28.08.18	First Drawing

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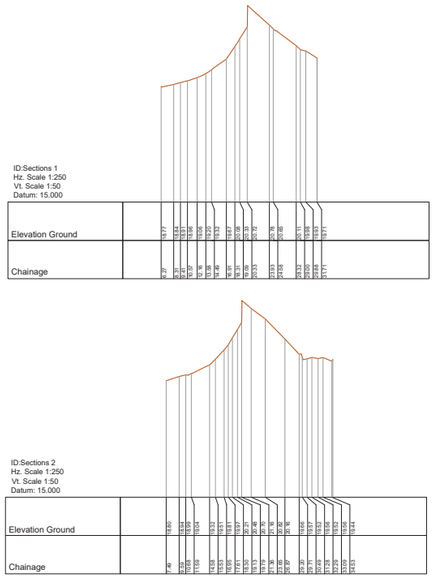
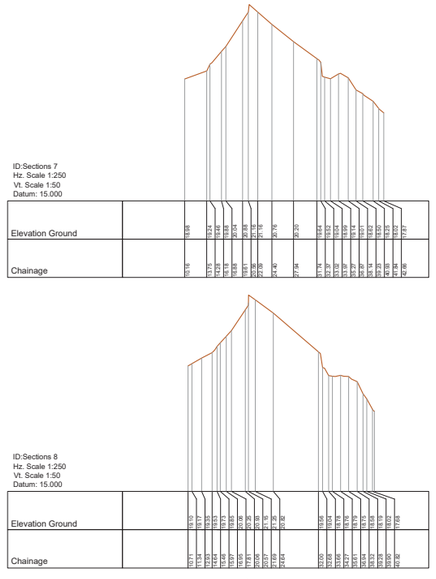
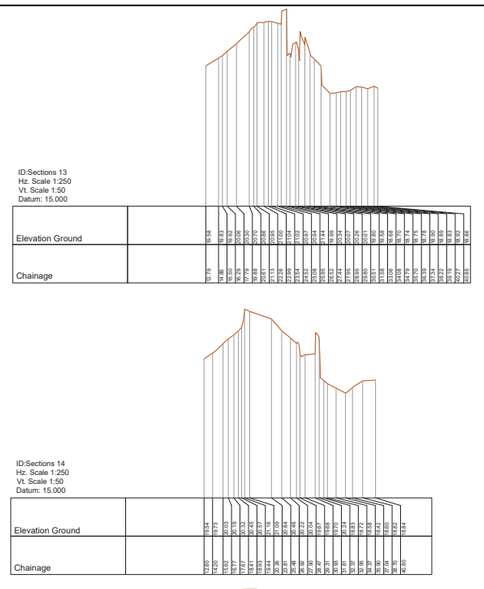
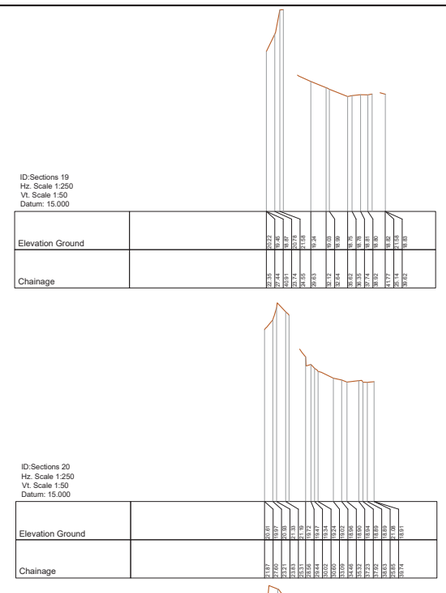
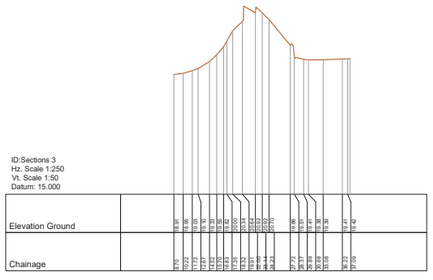
Client :	TJ_O_Connor_&_Associates
Project :	27232 18024_Fermoy_Weir
Date : 28.08.18	**Scale :** 1:250@A1
Description :	Topographical Survey
Drawing Number :	FERMOY WEIR_CROSS SECTIONS_PLAN

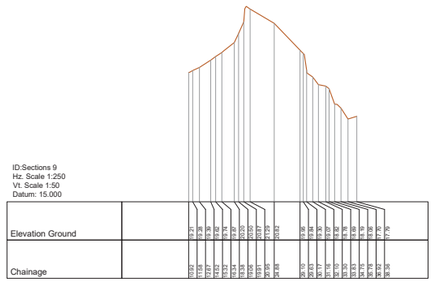


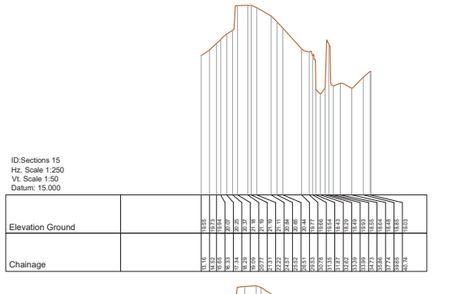


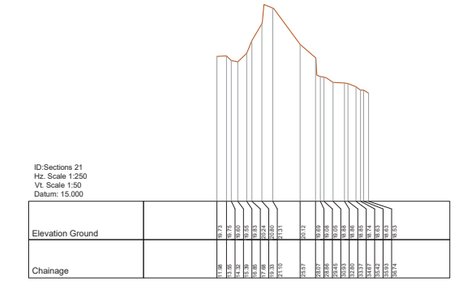


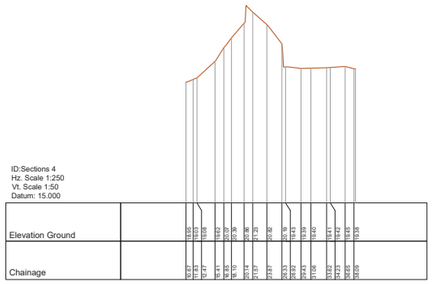


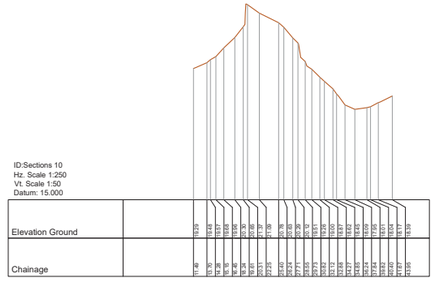


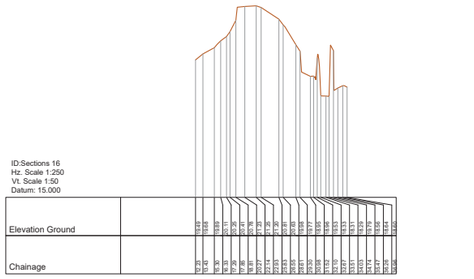


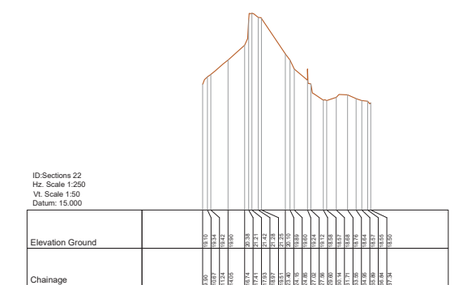


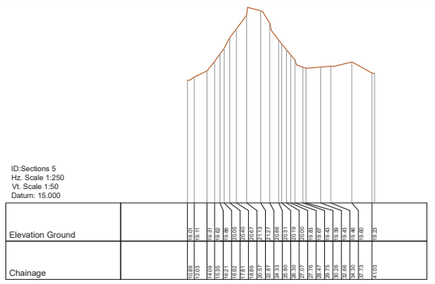


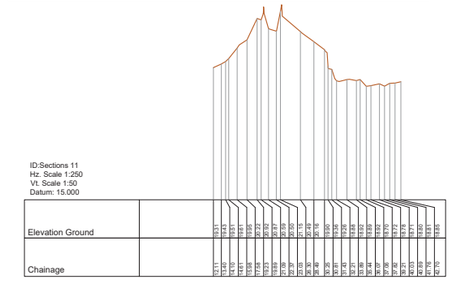


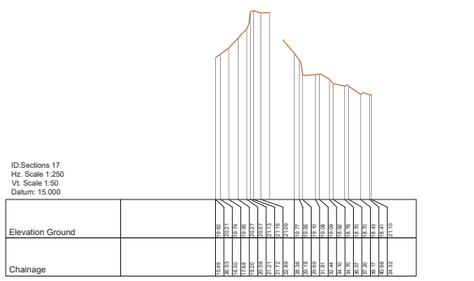


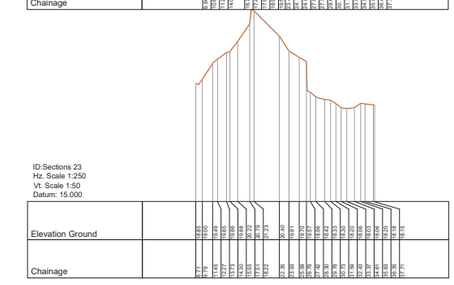


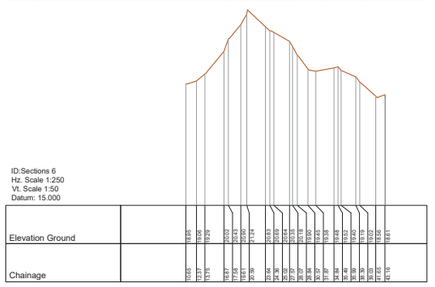


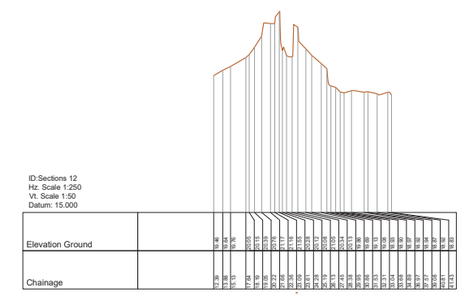


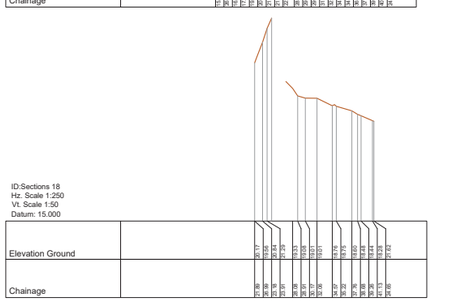


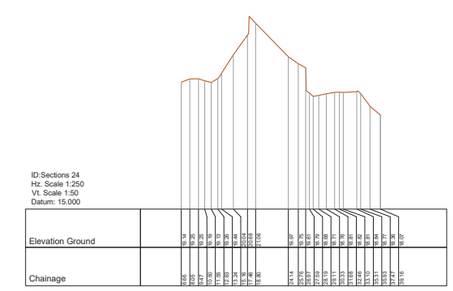












LEGEND
Street furniture & Services

- Over Head Wires (LUAS) - Pylon ESB
- Flowerbed
- Pipe
- Lift
- Barrier
- Pump
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- NTL Inspection Cover
- Eircom Inspection Cover
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- Photo point
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- Parapet Height
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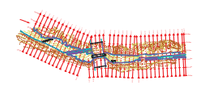
Map Sheet Layout:



Surveyed by : MSL	Date: Aug 2018	Datum:	Malin Head
Drawn by : BK	Date: Aug 2018	Grid System:	
Checked by : KC	Date: Aug 2018	Irish National Grid ☐ ITM ■	

Revisions

No.	Date	Description
1	28.08.18	First Drawing

Murphy Surveys
Global Consulting Surveyors

Topographic surveys, Measured Building Surveys, Setting-Out, As-Built Surveys, Hydrographic Surveys, Legal Mapping, Pipeline Surveys, Services Location, Ground Penetrating Radar, Laser Scanning, Rectified Photography

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Phone: (+353) 045 484040
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Email: info@murphysurveys.ie

Client :	TJ_O_Connor_&_Associates
Project :	27232 18024_Fermoy_Weir
Date : 28.08.18	**Scale :** AS SHOWN@A1
Description :	Topographical Survey
Drawing Number :	FERMOY WEIR_CROSS SECTIONS_PROFILE_01

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Vt. Scale 1:50
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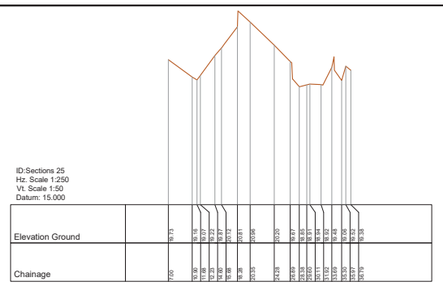

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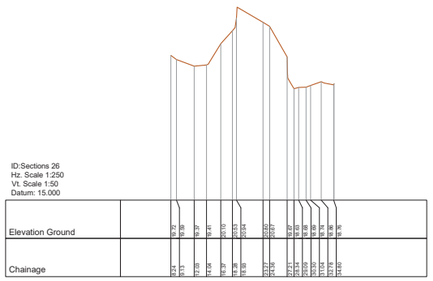

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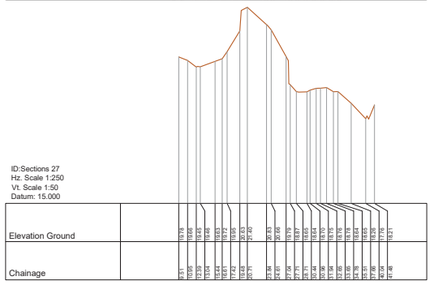

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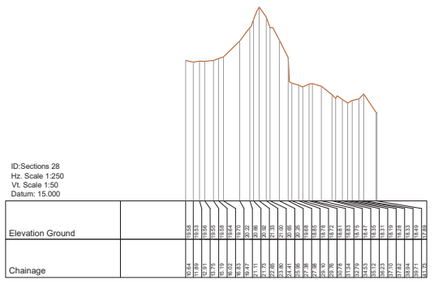

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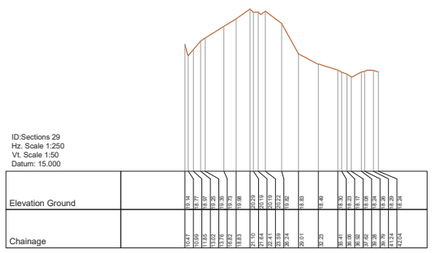

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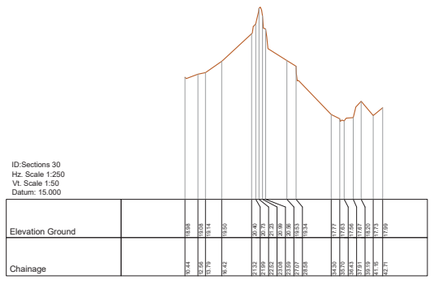

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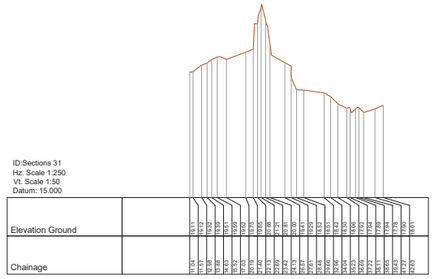

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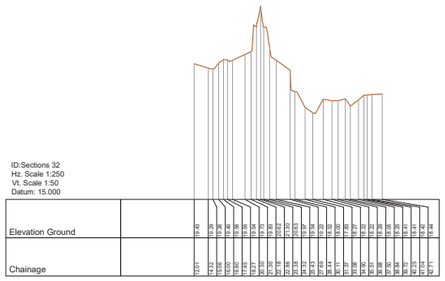

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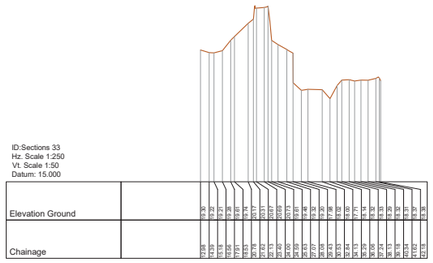

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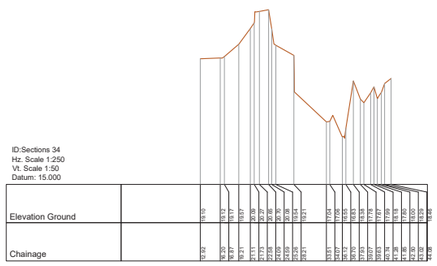

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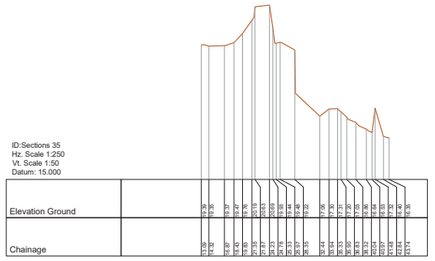

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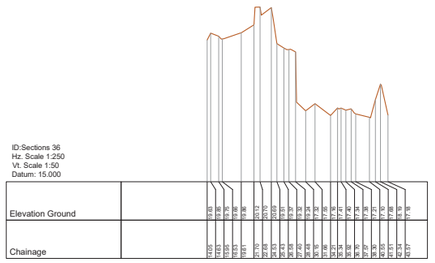

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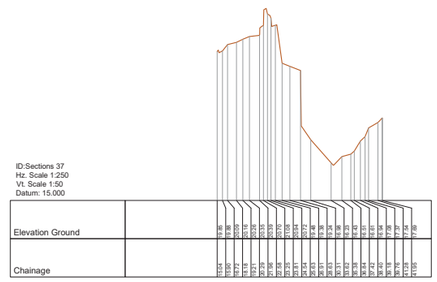

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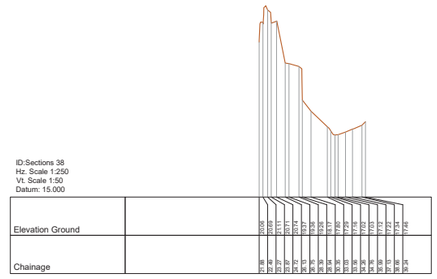

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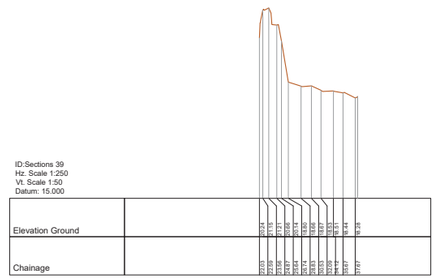

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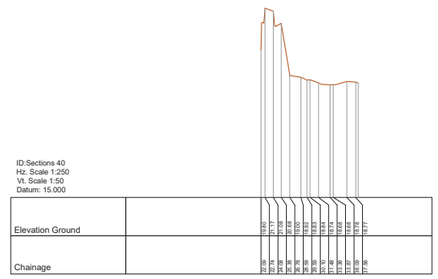

LEGEND

Street furniture & Services

- Over Head Wires (LUAS) - Pylon ESB
- Flowerbed
- Pipe
- Lift
- Barrier
- Pump
- Trial Pit
- Bus/Tram Shelter
- Postbox
- Valve - General
- Water Valve
- Gas Valve
- Sluice Valve
- Air Valve
- Stop Cock
- C P Post
- Marker Post
- Traffic light
- Parking Meter
- Plane Aerial Mark
- Smart Card Validator
- Unknown Valve
- Road Sign
- Bus Stop
- Bollard
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- Coalhole Cover
- Bore Hole
- Electricity Pole
- Telegraph pole
- OCS Pole
- CCTV Camera Pole
- Lamp Post
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- Kiosk
- Gully
- Waste Bin
- Hydrant
- Fire Hydrant
- ESB Box
- ESB Inspection Cover
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- Telecom Inspection Cover
- Monument / Toilets
- Tank Storage
- Basement: MH, Cover & Pipe
- Dished Aerial Mark
- Stay for pole
- Pipe Protection
- Washout

Natural Features

- Surface Change
- Land Drain
- Bottom of Slope
- Top of Slope
- Ditch
- Water Edge / Lake / Pond
- Hedge / Trees Drip Line / Vegetation
- Tree Coniferous
- Water Level
- Crown Level
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- Bed Level
- Spotheight
- Top of Tree
- Tree Deciduous

Golf

- Fair Way
- Green
- Tee Box

Other

- Survey Station
- Photo point
- River Alignment

Built Features

Roads & Road Markings

- Building
- Edge of Road
- Kerb Bottom
- Kerb Top
- Bridge Abutment
- Bridge Deck
- Bridge Parapet
- Building Façade
- Footpath / Platform Train & Tram
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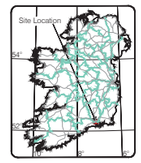
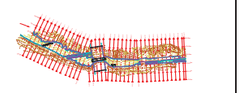


Map Sheet Layout:



Surveyed by : MSL	Date: Aug 2018	Datum:	Malin Head
Drawn by : BK	Date: Aug 2018	Grid System:	
Checked by : KC	Date: Aug 2018	Irish National Grid ☐ ITM ■	

Revisions

No.	Date	Description
1	28.08.18	First Drawing

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GLOBAL CONSULTING SURVEYORS

Topographic surveys, Measured Building Surveys, Setting-Out, As-Built Surveys, Hydrographic Surveys, Legal Mapping, Pipeline Surveys, Services Location, Ground Penetrating Radar, Laser Scanning, Rectified Photography

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Ireland

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Fax: (+353) 045 484004
Email: info@murphysurveys.ie

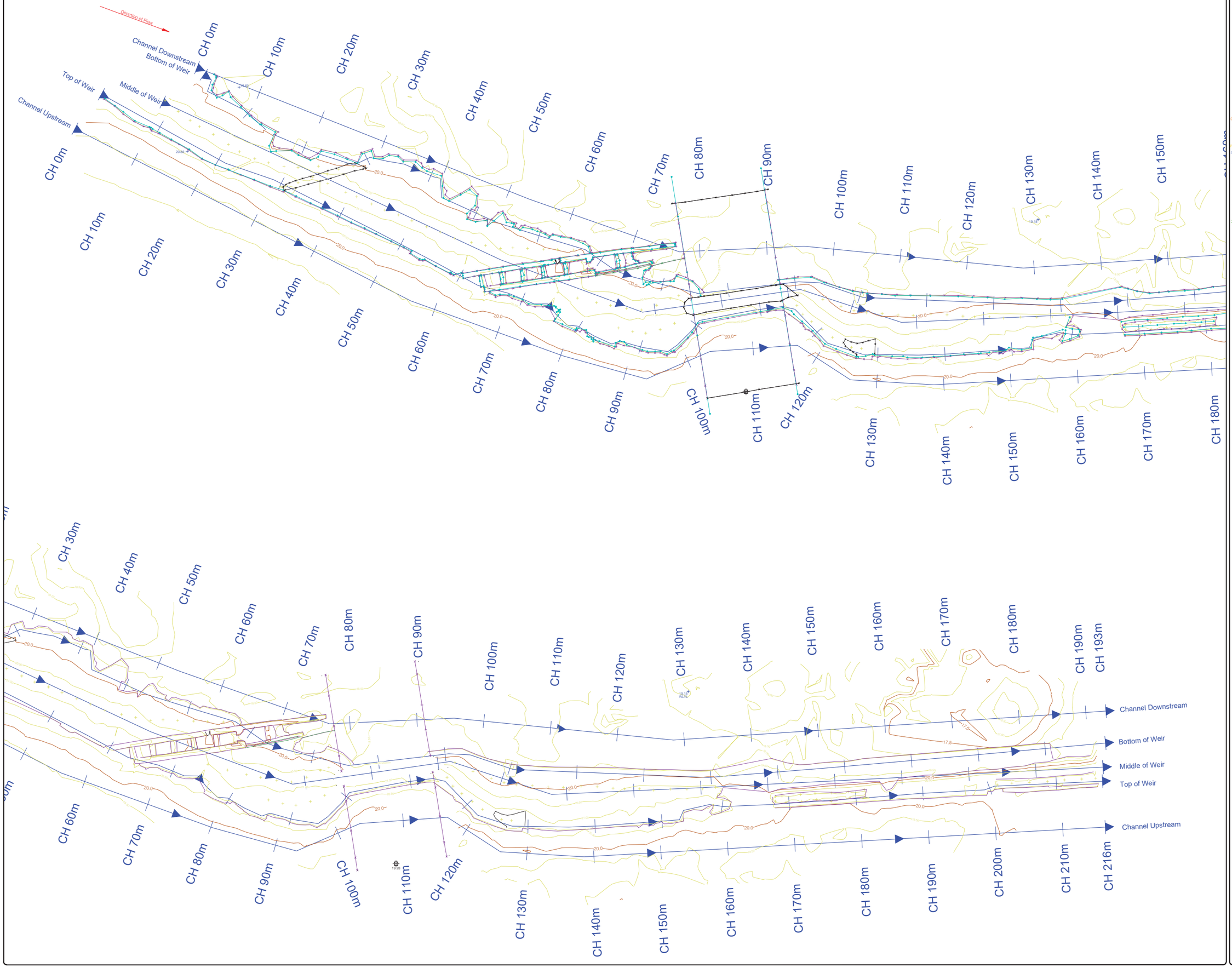
Client : TJ_O'Connor_&_Associates

Project : 27232 18024_Fermoy_Weir

Date : 28.08.18 **Scale :** AS SHOWN@A1

Description : Topographical Survey

Drawing Number : FERMOY WEIR_CROSS SECTIONS_PROFILE_02



LEGEND

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- Dished Aerial Mark
- Stay for pole
- Pipe Protection
- Washout
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- Bridge Deck
- Bridge Parapet
- Building Façade
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- Top of Wall
- Hoarding
- Property Line
- Road Scar
- Top of Fence
- Floor Level
- Apex Height
- Eaves Height
- Parapet Height
- Soffit Elevation
- Step Level
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Site Location:

Map Sheet Layout:

Surveyed by : MSL	Date: Aug 2018	Datum:	Malin Head
Drawn by : BK	Date: Aug 2018	Grid System:	
Checked by : KC	Date: Aug 2018		Irish National Grid ☐ ITM ■

Revisions

No	Date	Description
1	28.08.18	First Drawing

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Topographic surveys, Measured Building Surveys, Setting-Out, As-Built Surveys, Hydrographic Surveys, Legal Mapping, Pipeline Surveys, Services Location, Ground Penetrating Radar, Laser Scanning, Rectified Photography

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Kilcullen Business Campus
Kilcullen Co. Kildare
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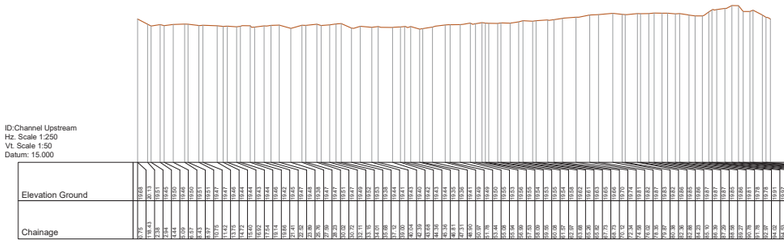
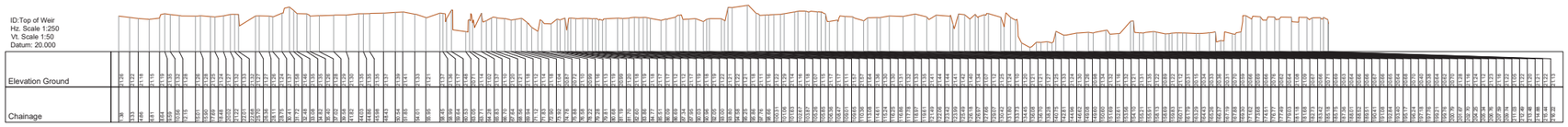
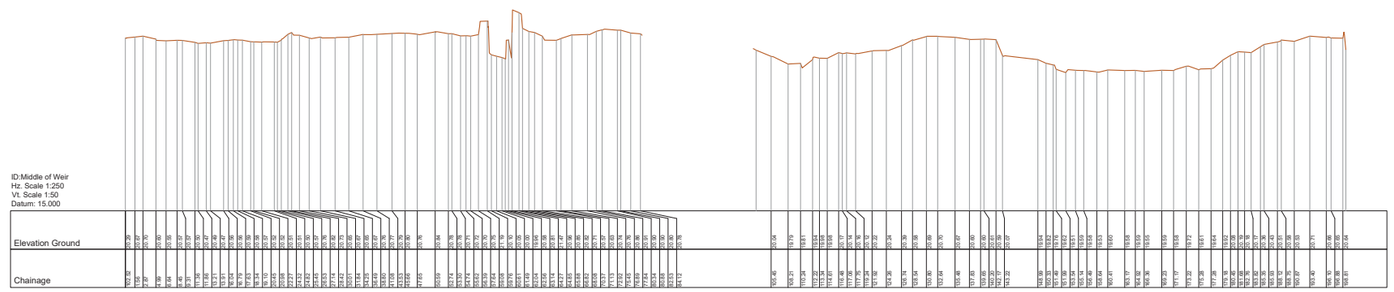
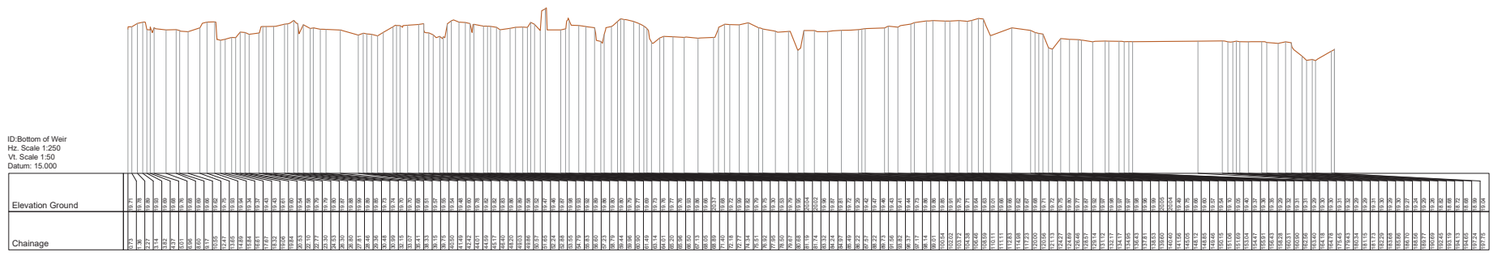
Fax: (+353) 045 484004
Email: info@murphysurveys.ie

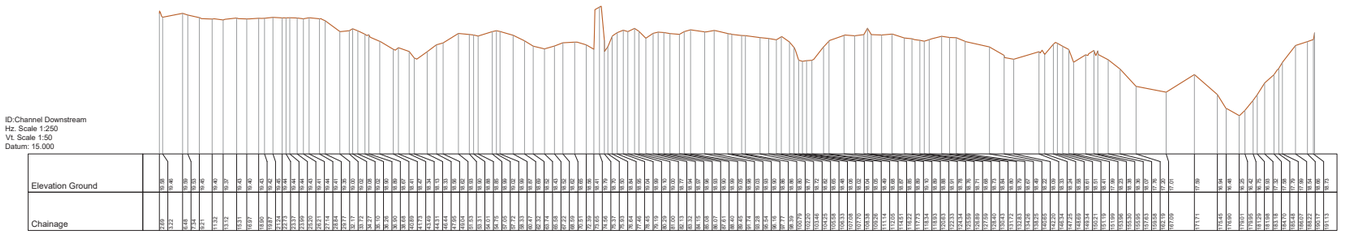
Client :	TJ_O_Connor_&_Associates
Project :	27232 18024_Fermoy_Weir
Date : 28.08.18	**Scale :** 1:250@A1
Description :	Topographical Survey
Drawing Number :	FERMOY WEIR_LONG SECTION_PLAN











LEGEND

Street furniture & Services

- Over Head Wires (LUAS) - Pylon ESB
- Flowerbed
- Pipe
- Lift
- Barrier
- Pump
- Trial Pit
- Bus/Tram Shelter
- Postbox
- Valve - General
- Water Valve
- Gas Valve
- Sluice Valve
- Air Valve
- Stop Cock
- C P Post
- Marker Post
- Traffic light
- Parking Meter
- Plane Aerial Mark
- Smart Card Validator
- Unknown Valve
- Road Sign
- Bus Stop
- Bollard
- Beacon
- Coalhole Cover
- Bore Hole
- Electricity Pole
- Telegraph pole
- OCS Pole
- CCTV Camera Pole
- Lamp Post
- Foul Manhole
- Surface Water MH
- Manholes
- Air Conditioning Vents
- Services Inspection Cover
- Traffic Inspection Cover
- Cable TV Inspection Cover
- ESAT Inspection Cover
- NTL Inspection Cover
- Eircom Inspection Cover
- Rodding Eye
- Phone Box
- Bench Seat
- Kiosk
- Gully
- Waste Bin
- Hydrant
- Fire Hydrant
- ESB Box
- ESB Inspection Cover
- Traffic Control Box
- LUAS Technical Cubicle
- Ticket Vending Machine
- Water Meter Cover
- Telecom Inspection Cover
- Monument / Toilets
- Tank Storage
- Basement: MH, Cover & Pipe
- Dished Aerial Mark
- Stay for pole
- Pipe Protection
- Washout
- Duct
- Gas Cover
- C P Box
- U/G Car Park Vent

Natural Features

- Surface Change
- Land Drain
- Bottom of Slope
- Top of Slope
- Ditch
- Water Edge / Lake / Pond
- Hedge / Trees Drip Line / Vegetation
- Tree Coniferous
- Water Level
- Crown Level
- Invert level
- Bed Level
- Spotheight
- Top of Tree
- Tree Deciduous

Golf

- Fair Way
- Green
- Tee Box

Other

- Survey Station
- Photo point
- River Alignment

Built Features

Roads & Road Markings

- Building
- Edge of Road
- Kerb Bottom
- Kerb Top
- Bridge Abutment
- Bridge Deck
- Bridge Parapet
- Building Façade
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- Top of Wall
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- Road Scar
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- Soffit Elevation
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Site Location:

Map Sheet Layout:

Surveyed by : MSL	Date: Aug 2018	Datum:	Malin Head
Drawn by : BK	Date: Aug 2018	Grid System:	
Checked by : KC	Date: Aug 2018	Irish National Grid ☐ ITM ■	

Revisions

No:	Date	Description:
0	28.08.18	First Drawing

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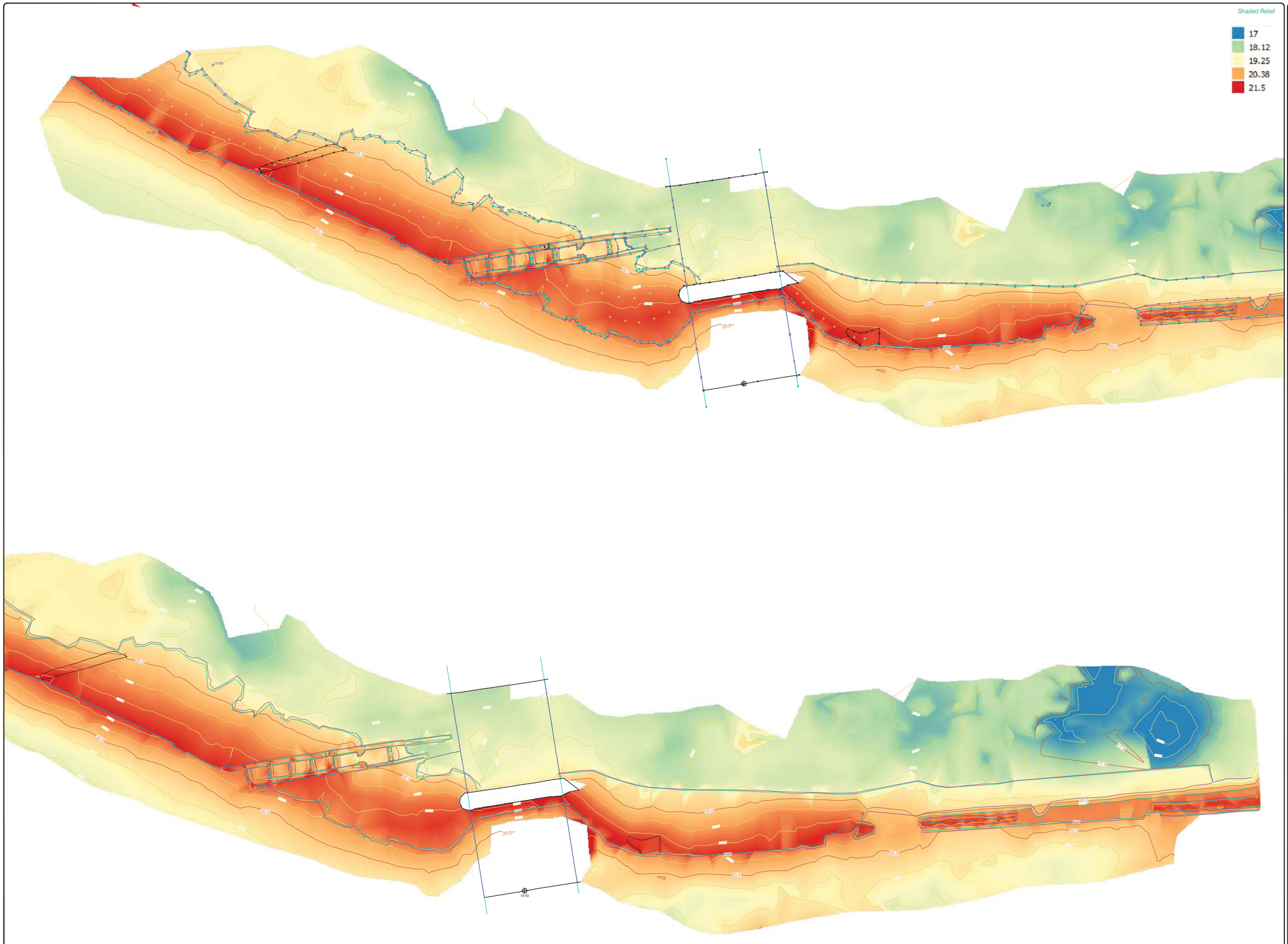
Client :	TJ_O_Connor_&_Associates
Project :	27232 18024_Fermoy_Weir
Date : 28.08.18	**Scale :** AS SHOWN@A1
Description :	Topographical Survey
Drawing Number :	**FERMOY WEIR_LONG SECTION_01**



LEGEND

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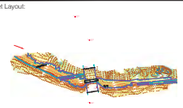
Map Sheet Layout:



Surveyed by: MSL Date: Aug 2018 Datum: Malin Head
Drawn by : BK Date: Aug 2018 Grid System:
Checked by : KC Date: Aug 2018 Irish National Grid ☐ ITM ■

Revisions

No	Date	Description
0	28.08.18	First Drawing

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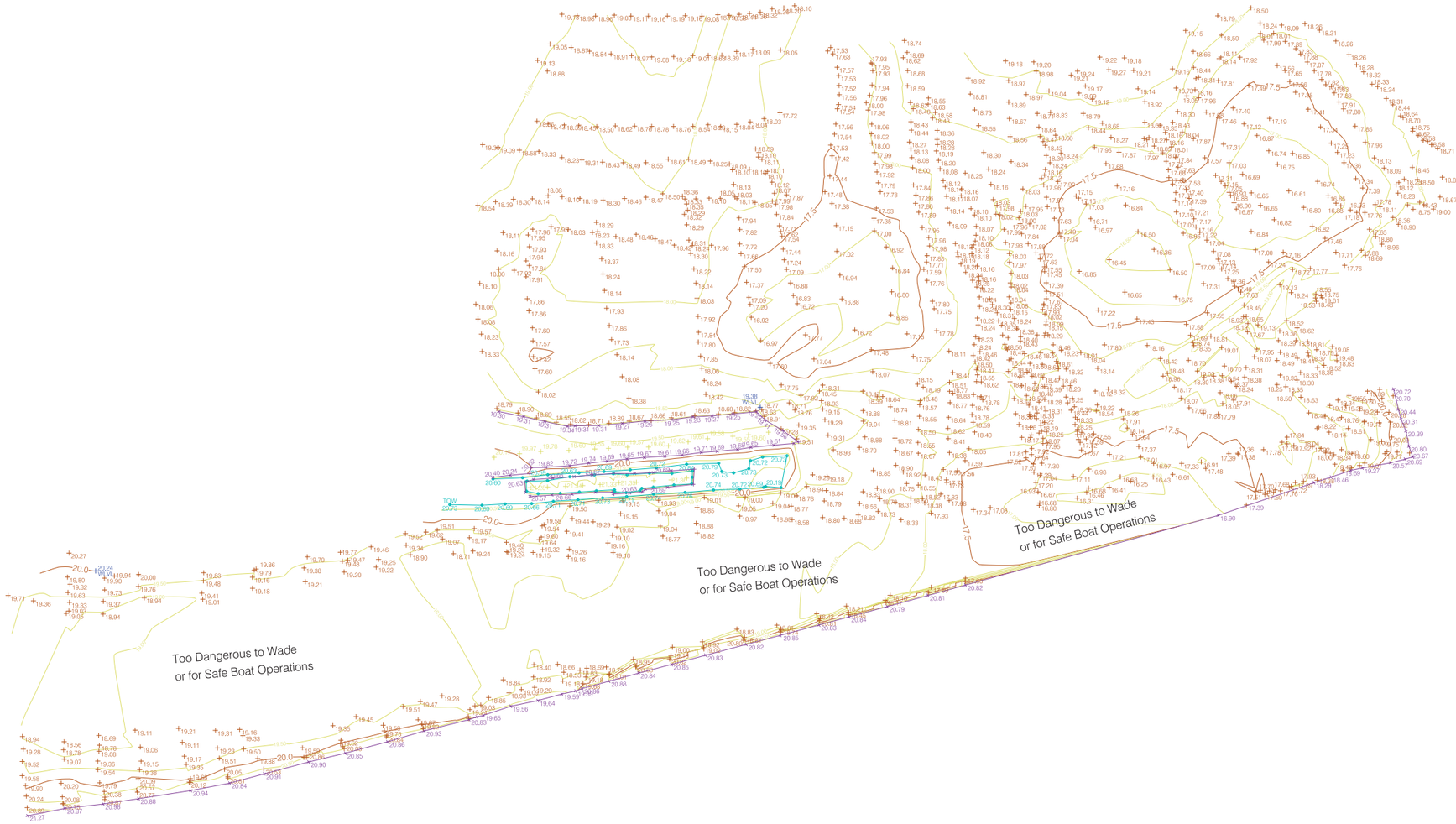
Client :	TJ_O_Connor_&_Associates
Project :	27232 18024_Fermoy_Weir
Date : 28.08.18	**Scale :** 1:250@A1
Description :	Topographical Survey
Drawing Number :	**FERMOY WEIR_DTM**



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North

Site Location

Map Sheet Layout:

Map Sheet 0000

Surveyed by : MSL	Date: Aug 2020	Datum:	Malin Head
Drawn by : CE	Date: Aug 2020	Grid System:	Irish National Grid ☐ ITM ■
Checked by : BK	Date: 12.08.20		

Revisions

No.	Date	Description
0	11.08.20	First Drawing

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Client :	TJ O connor & Associates
Project :	Fermoy Mill Race River Bed Survey
Date : 11.08.20	**Scale :** 1:150@A0
Description :	River Bed Survey
Drawing Number :	**MSL3□□□0_01**