FERMOY WEIR REMEDIATION AND FISH BYPASS CHANNEL

Options Report

NOVEMBER 2020

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Document Verification

Client:	Cork County Council
Project Name:	Fermoy Weir Remediation and Fish Bypass Channel Project
Project Ref:	19011
Document Title:	Options Report
File Name:	19011-TJOC-ZZ-XX-RP-C-3706_Options_Report

Revision Code	Status Code	Description of Revision	Prepared By	Checked By	Approved By	Date of Issue
P01	S03	First Draft	MV	DC	EF	29/10/2020
C01	AP	Public Consultation Issue	MV	DC	EF	04/11/2020

EXECUTIVE SUMMARY

T.J. O'Connor and Associates was engaged by Cork County Council in September 2019 to provide civil engineering consultancy services for the Fermoy Weir Remediation and Fish Bypass Channel project.

The river Blackwater weir and adjacent limestone quay wall at O'Neill Crowley Quay are included in the Fermoy Record of Protected Structures in the Fermoy Development Plan (2010-2016). Works that materially alter a protected structure require planning approval, irrespective of any applicable exemptions, if the works would affect the character of the structure or any element of the structure that contributes to its special interest.

The weir is located in the Blackwater river which is encompassed by the Munster Blackwater Special Area of Conservation (SAC). This adds to the difficulty of carrying out any remedial works to the existing weir.

Investigations which are been undertaken in accordance with the project brief for the preparation of proposals and planning documentation for the remediation of Fermoy weir and the provision of a fish bypass channel are currently ongoing. These surveys are required to be completed to support the planning application for the scheme and to inform the design approach and Appropriate Assessment.

9 No. options were identified for the fish bypass element of the works, some of which were identified in 2014, i.e. options 3, 5, 7 and 9, with others identified on foot of further meetings and consultations with the relevant stakeholders in 2020, i.e. options 1, 2, 4, 6 and 8. These options are discussed in detail in Section 4.

Not all of these options are viable as some would be contrary to legal obligations arising under Habitats Directive and planning legislation.

The recommended solution for remediating the weir is mitigation by design. The materials to be used for the remediation works will consist of the existing masonry and rubble where possible. In addition, new masonry closely resembling that of the existing masonry, may also be used where necessary should there be a shortfall of masonry. The precise details for the weir remediation works will be reviewed on foot of the findings from the underwater archaeological survey.

A stakeholder management plan has been developed for the project. The stakeholder management plan will be populated as the project progresses and additional stakeholders are identified.

Having identified the potential options for the scheme, a stakeholder and public consultation process will be initiated, where feedback and comments on the options identified will be invited and considered. On completion of the public consultation process, a preferred solution for the weir remediation and fish bypass project will be identified.

The development of planning documentation for the proposed scheme will then be the next major project task on the programme for delivery. It is expected that the planning documents and drawings will be prepared for submission to An Bord Pleanála in Q1 2021.

CONTENTS

1. SCOPE OF PROJECT 1
1.1. Introduction 1
1.2. Project Objectives 1
1.3. Location of Scheme 1
1.4. Background to Fermoy Weir & Fish Pass 3
1.4.1. History of Weir 3
1.4.2. Existing Fish Pass 4
1.4.3. Description of Fermoy Weir 5
1.4.4. Progressive Collapse of Mill Race Weir Wall 8
1.4.5. Previous Studies and Reports 11
1.5. Protected Weir & Blackwater SAC 12
1.5.1. Protected Status of Existing Weir 12
1.5.2. Designated Special Area of Conservation 13

2. RIVER BLACKWATER – HYDROLOGY 16
2.1. Munster Backwater Fermoy Drainage Scheme 16
2.2. Design Flows 16

3. PLANNING CONSIDERATIONS 19
3.1. Appropriate Assessment Requirements 19
3.2. Flood Risk Assessment 20
3.3. Topographical Survey 20
3.4. Additional Third-Party Surveys & Specialist Surveys 20
3.4.1. Underwater Archaeological Survey 20
3.4.2. Weir Inspection 21
3.4.3. Bathymetric Survey 22
3.4.4. Survey of Bank Erosion & Bankside Structures 22
3.4.5. Ecological Surveys 23
3.5. Stakeholders 23
3.6. Arterial Drainage Consents 24
3.6.1. Munster Blackwater Drainage Scheme Minutes of 05/12/19 25
3.7. Other Requirements & Constraints 25
3.7.1. Water Framework Directive 25
3.7.1. OPW Flood Embankments 26
3.7.2. Rowing Club 26

4. REVIEW OF OPTIONS 27
4.1. Options Considered 27
4.1.1. Weir Remediation 27
4.1.1.1 Conservation Engineers Report 27
4.1.1.2 Remediation of Crump Weir Section 28
4.1.1.3 Remediation of Mill Race Weir Section 28
4.1.1.4 Remediation of Existing Fish Pass 29
4.1.2. Fish Bypass Channel 29

4.1.2.1 Option 1 – Do Nothing Scenario 30
4.1.2.2 Option 2 – Stabilise Remaining Section of Existing Weir 30
4.1.2.3 Option 3 – Remediate Existing Fish Pass 30
4.1.2.4 Option 4 – Complete Removal of Existing Weir 32
4.1.2.5 Option 5 – Construct an In-River Rock Ramp 32
4.1.2.6 Option 6 – Construct Fish Ramp (Rock Ramp) in Existing Breach 33
4.1.2.7 Option 7 – Construct a Near Natural Bypass Channel 33
4.1.2.8 Option 8 – Bypass River around weir 34
4.1.2.9 Option 9 – Construct a Rough Channel Pool Bypass 34
4.2. Assessment of Options 35
4.2.1. Option 1 – Do-Nothing 35
4.2.2. Option 2 – Stabilise Remaining Section of Existing Weir 36
4.2.3. Option 3 – Remediate Existing Fish Pass 37
4.2.4. Option 4 – Complete Removal of Existing Weir 38
4.2.5. Option 5 – Construct an In-River Rock Ramp 38
4.2.6. Option 6 – Construct Fish Ramp (Rock Ramp) in Existing Breach 39
4.2.7. Option 7 – Construct a Near Natural Bypass Channel 40
4.2.8. Option 8 – Bypass River Around Weir 41
4.2.9. Option 9 – Construct a Rough Channel Pool Bypass 42
4.2.10. Summary 43
4.3. Land Acquisition 44
4.3.1. Fish Bypass Channel 44
4.3.2. Mill Race Works 44
5. NEXT STEPS 46
5.1. Development of Planning Documentation 46

FIGURES

Figure 1-1: Aerial View Map (TJOC DRG No. 19011-TJOC-XX-XX-DR-C-0001) 2
Figure 1-2: Site Location 3
Figure 1-3: Fermoy Fish Pass – July 2019 4
Figure 1-4: Fermoy Fish Pass – Eblana Collection (ca. 1870-1890) 5
Figure 1-5: Fermoy Fish Pass – Lawrence Collection (1894) 5
Figure 1-6: Fermoy Weir Upstream – July 2019 6
Figure 1-7: Typical Cross Section Through Crump (embankment) Weir at Fermoy 7
Figure 1-8: Typical Section through Gravity Wall Weir at Fermoy 7
Figure 1-9: Fermoy Weir at Mill Race Weir Wall– July 2019 8

Figure 1-10: Fermoy Weir Concrete Apron (Upstream) – July 2019 8
Figure 1-11: Fermoy Weir – Mill Race Weir Wall March 2013 9
Figure 1-12: Fermoy Weir – Mill Race Weir Wall August 2016 9
Figure 1-13: Fermoy Weir – Mill Race Weir Wall June 2019 10
Figure 1-14: Fermoy Weir – East End of Mill Race Weir Wall June 2019 10
Figure 1-15: Fermoy Weir – East End of Mill Race Weir Wall December 2019 11
Figure 1-16: Protected Structures in Fermoy 13
Figure 4-1: Existing Fish Pass at Fermoy Weir - November 2019 31
Figure 4-2: Rough Channel Pool Pass Details 35
Figure 4-3: Land and Easements to be Acquired for Proposed Works 44

TABLES

Table 2-1: UoM18 Design Peak Flood Flows at Fermoy 17
Table 2-2: River Level Gauges at Fermoy 17
Table 2-3: Flow Duration Statistics for Station 18107 at Fermoy 17

APPENDICES

Appendix A: Historical Photos of Weir
Appendix B: 2014 Fish Pass Options
Appendix C: Options considered for Fermoy Weir Remediation and Fish Bypass project

ABBREVIATIONS

AA	Appropriate Assessment
ABP	An Bord Pleanála
AGL	Advanced Geotechnics Ltd. Consulting Engineers
CCC	Cork County Council
CEMP	Construction Environmental Management Plan
CFRAMS	Catchment Flood Risk Assessment and Management Study
DAU	Development Applications Unit
DCENR	Department of Energy and Natural Resources
DCHG	Department of Culture, Heritage and the Gaeltacht
DVWK	Deutscher Verband für Wasserwirtschaft und Kulturbau e.V.
EcIA	Ecological Impact Assessment
EIA	Environmental Impact Assessment
EU	European Union
FAO	Food and Agriculture Organisation of the United States
IFI	Inland Fisheries Ireland
MCA	Multi Criteria Analysis
NIA	Natura Impact Assessment
NIS	Natura Impact Statement
NPWS	National Parks and Wildlife Services
OPW	Office of Public Works
RBMP	River Basin Management Plan
SAC	Special Area of Conservation
TJOC	T.J. O'Connor & Associates Consulting Engineers
TWCE	Trevor Wood Consulting Engineers
UAIA	Underwater Archaeological Impact Assessment

1. SCOPE OF PROJECT

1.1. Introduction

Cork County Council has identified the need to carry out remediation works to the existing Weir in Fermoy and to construct a new permanent Fish Bypass channel on the north bank. T.J. O'Connor & Associates (TJOC) were appointed by Cork County Council in September 2019 to provide civil engineering consultancy services for the project and to develop a scheme that represents value for money while also complying with the relevant standards and statutory requirements.

1.2. Project Objectives

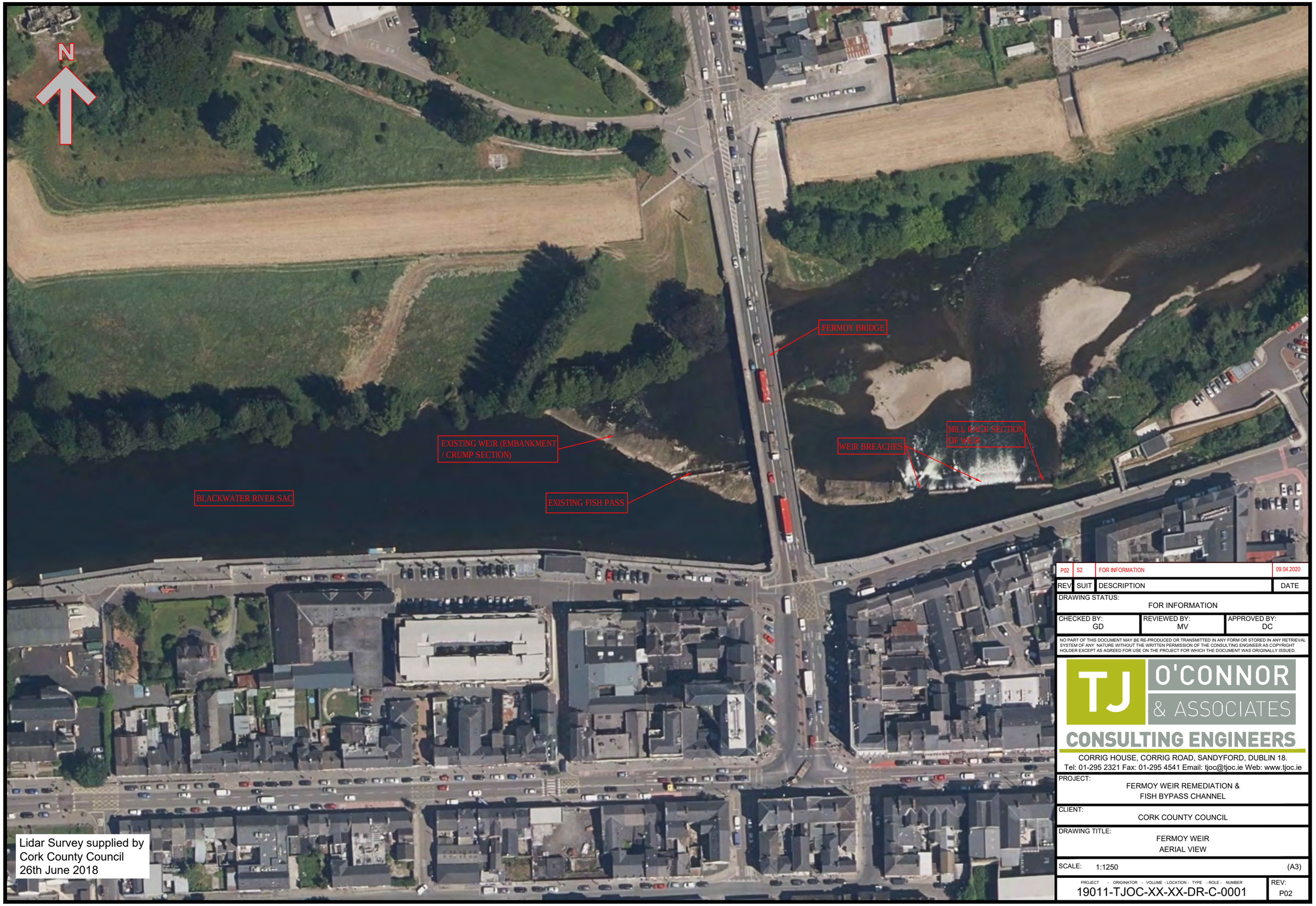
As stated above, Cork County Council wish to carry out remediation works to the existing weir in Fermoy and to construct a permanent Fish Bypass channel on the north bank of the river Blackwater.

The objective of the project is to identify and assess potential options for the scheme in order to identify the preferred solution for the project following consultation with all relevant stakeholders. The preferred option will then be designed and developed into a viable, cost effective and sustainable scheme which will comply with the relevant standards and statutory requirements.

The project requires Cork Co Co to fulfil its obligations to maintain and repair the weir at Fermoy, a Protected Structure under Section IV of the Planning & Development Act 2000, while complying with the conservation and fisheries obligations to provide for the free passage of fish along the river Blackwater arising under the Water Framework Directive, Habitats Directive and Inland Fisheries Act 2010 and related legislation.

1.3. Location of Scheme

Fermoy is located approx. 35km north of Cork City. The existing weir and fish pass are located on the River Blackwater, at Fermoy bridge which is situated to the north of Fermoy town and to the west of the M8 motorway. Figure 1-1 and Figure 1-2 show an aerial view and site location map for the scheme respectively.



REV	SUIT	DESCRIPTION	DATE
P02	S2	FOR INFORMATION	09.04.2020

DRAWING STATUS: FOR INFORMATION

CHECKED BY:	REVIEWED BY:	APPROVED BY:
GD	MV	DC

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PROJECT: FERMOY WEIR REMEDIATION & FISH BYPASS CHANNEL

CLIENT: CORK COUNTY COUNCIL

DRAWING TITLE: FERMOY WEIR AERIAL VIEW

SCALE: 1:1250 (A3)

PROJECT - ORIGINATOR - VOLUME - LOCATION - TYPE - ROLE - NUMBER
19011-TJOC-XX-XX-DR-C-0001

REV: P02

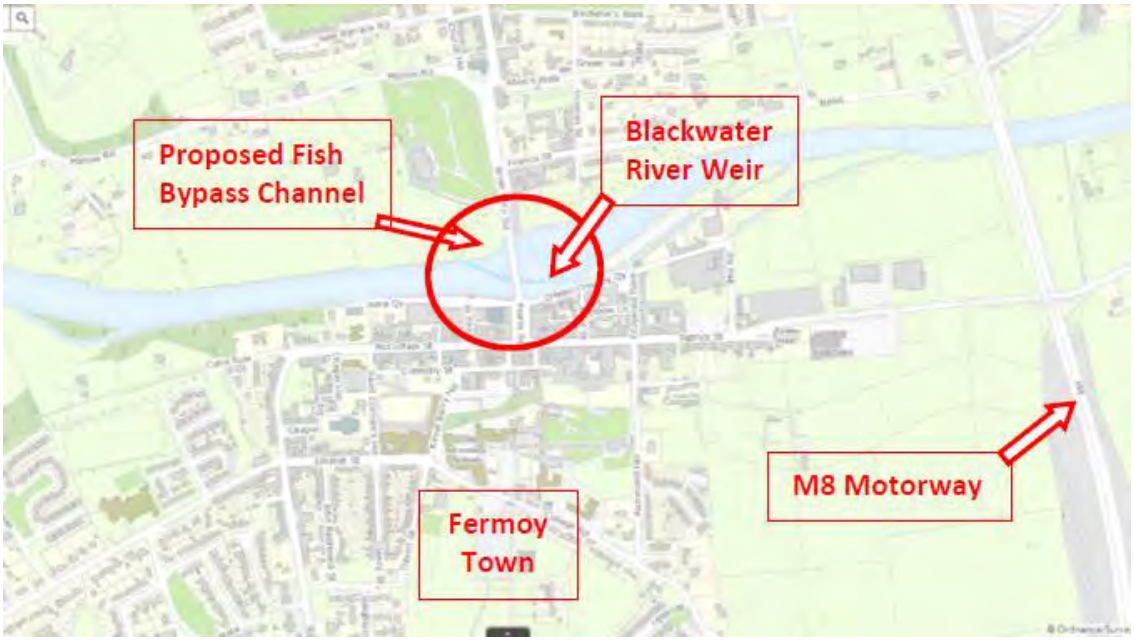


Figure 1-2: Site Location

1.4. Background to Fermoy Weir & Fish Pass

1.4.1. History of Weir

Fermoy Weir was constructed using different methods over its length but in general, it is constructed as a stone filled embankment with large natural stone bedded in mortar and capped with a thin in-situ concrete capping. The weir has been subjected to localised damage over the years with the capping disintegrating due to the powerful flows in the River Blackwater. In winter floods, large trees are often conveyed by the river in flood flows and have the potential to cause significant damage to the weir.

Paul Kavanagh, in his statement to the Dáil Petitions Committee on the 8th May 2019, stated that "There has been a weir on Fermoy's Blackwater for at least 800 years, since the Cistercian monks built their abbey Sancta Maria de Castro Dei (Our Lady of the Camp of God), somewhere on what is now Ashe Quay." He also said that there was a reference to a weir in Fermoy in historical documents dating back to the 1540's.

The present weir and Mill Race were completed in 1802 according to Dan Noonan in his Archaeological Assessment Report for Fermoy South Drainage Scheme. The Mill Race powered a flour mill that was constructed at the same time. A paper mill was located further downstream. The Flour Mill structure still stands but has not been operated for that purpose for many years. Most recently the Flour Mill buildings were used as offices. The paper mill has been demolished for many years. The Flour Mill is a Recorded Archaeological Monument (RMP C0035-025). The weir at Fermoy is an integral part of the Mill.

The Fermoy Weir is included in the Record of Protected Structures in the Fermoy Development Plan (2010-2016). The adjacent limestone quay wall at O'Neill Crowley Quay was delisted in a variation to the Fermoy Development Plan. A new quay wall was

constructed in front of the existing quay wall as part of the Fermoy South Drainage Scheme flood defence works. The section of the original quay wall which was below the original road level was not demolished and remains buried under the footpath at O'Neill Crowley Quay.

Historical photos of the weir dating back to the 19th century, some of which also include photos of the existing fish bypass, are included in Appendix A of this report.

1.4.2. Existing Fish Pass

The existing fish pass is of masonry construction as can be seen in Figure 1-3 below. According to Fisheries Ireland its diagonal position in the centre of the river is not suited for the successful passage of migrating fish.

The fish pass is located towards the centre of the weir. This means that the white-water attraction at the entrance to the fish pass is not ideally situated. The optimum location for the entrance to a fish pass on a diagonal weir should be at the furthest upstream point on the downstream side of the weir.

Figure 1-3: Fermoy Fish Pass – July 2019

The Fish Pass was referred to as the Salmon Leap in the past and photographs exist in the National Library Digital Online Collection showing the structure in the 19th Century. Two Photographs are reproduced at Figures 1-4 and 1-5 below. Figure 1-4 is an enlargement from a photograph from the Eblana Collection dated in the region 1860-1880. Figure 1-5 is an enlargement from a photograph from the Lawrence Collection dating from 1894 when a series of photographs were taken around the town of Fermoy, including several which included views of the weir.

Figure 1-4: Fermoy Fish Pass – Eblana Collection (ca. 1870-1890)

© National Library Eblana Collection

Figure 1-5: Fermoy Fish Pass – Lawrence Collection (1894)

© National Library Lawrence Collection

1.4.3. Description of Fermoy Weir

The existing Fermoy weir is of masonry and rubble construction as can be seen in Fig 1-6. It traverses the river Blackwater, extending diagonally from the north bank to the second pier of the bridge out from the southern bank of the river. The weir then runs in an easterly direction along the bridge pier and extends east of the bridge to the mouth of the Mill Race

at the eastern end of O'Neill Crowley Quay. The orientation of the weir in the river can be seen in Figure 1-1.

Figure 1-6: Fermoy Weir Upstream – July 2019

The cross section of the weir structure changes approximately 37m east of Fermoy Bridge. To the west of this point, the weir is a rubble embankment or Crump type weir (See typical section at Figure 1-7 and photo at Figure 1-10 below). To the east of this point, the cross-section is more like a gravity wall with a vertical face on the upstream side of the weir (See typical section at Figure 1-8 and photo at Figure 1-9 below). This cross section continues until it converges on the mouth of the Mill Race. The downstream face of the gravity wall is steeply stepped. It is this section of the weir that has deteriorated most in recent years.

AGL Geotechnical Consultants carried out a stability analysis on this section of the existing weir in 2018. They noted that the stability of the weir is governed by the weir geometry, shear strength of the underlying gravel, shear strength of the masonry stones, water level and the bulk unit weight of the weir structure. The analysis was carried out to investigate the effect that the loss of material had on the weir. A bulk unit weight of 20kN/m^3 was used in the assessment which was then reduced to 17kN/m^3 with the analysis repeated to account for material loss in the weir due to deterioration. The analysis concluded that the factor of safety reduced from 1.16 to 1.06 for a bulk unit weight of 20kN/m^3 and 17kN/m^3 respectively. Although this indicated at the time that the weir was stable, AGL noted that the factor of safety would not be acceptable for a design carried out in accordance with Eurocode 7. It is also worth noting that the condition of the weir has further deteriorated significantly since the 2018 analysis. It is therefore possible that the weir is no longer stable due to the loss of further material which in turn would have reduced the bulk unit weight of the structure.

A concrete apron (or screed) was placed over the masonry structure of the weir (Figure 1-10), upstream of the Mill Race Weir wall, by Fermoy Town Council at some stage in the past. It is understood that this occurred in the 1970's. Erosion of this apron has exposed

mesh reinforcement in places. However, it is not known if the mesh reinforcement was used throughout the full extent of the apron. There is evidence that the screed was also applied as a capping to the Mill Race Weir Wall structure at the same time. In the intervening decades the concrete apron or screed had suffered erosion and impact damage and, in many sections, has failed completely.

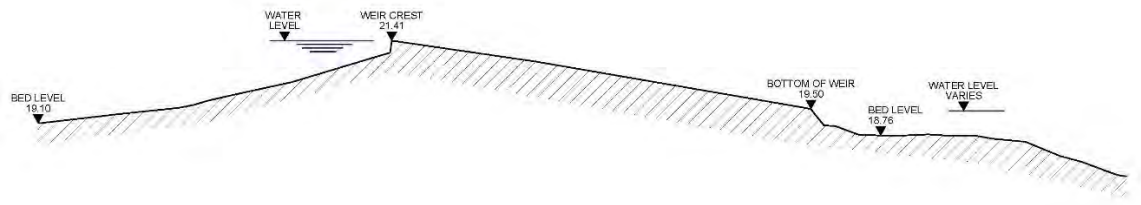


Figure 1-7: Typical Cross Section Through Crump (embankment) Weir at Fermoy

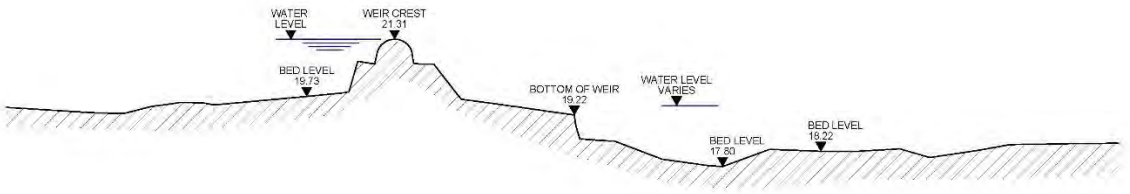


Figure 1-8: Typical Section through Gravity Wall Weir at Fermoy

Figure 1-9: Fermoy Weir at Mill Race Weir Wall– July 2019

Figure 1-10: Fermoy Weir Concrete Apron (Upstream) – July 2019

1.4.4. Progressive Collapse of Mill Race Weir Wall

The weir has deteriorated significantly in the past number of years since this was first highlighted by Inland Fisheries Ireland (IFI) in 2016. The Mill Race section of the weir in particular has deteriorated considerably as shown in Figures 1-11, 1-12 and 1-13 below.

Figure 1-11: Fermoy Weir – Mill Race Weir Wall March 2013

Figure 1-12: Fermoy Weir – Mill Race Weir Wall August 2016

Figure 1-13: Fermoy Weir – Mill Race Weir Wall June 2019

CCC, and previously Fermoy Town Council, have made significant efforts to get the repairs completed, initially proposing that the work was Exempted Development. However, we understand that the dual issues of the protected status of the weir, and its location within the Munster Blackwater Special Area of Conservation (SAC), have prevented the works proceeding as exempted development.

The damage to the weir is at its most severe at the eastern end of the Mill Race Weir wall where significant erosion has occurred as shown in Figures 1-14 and 1-15 below.

Figure 1-14: Fermoy Weir – East End of Mill Race Weir Wall June 2019

Figure 1-15: Fermoy Weir – East End of Mill Race Weir Wall December 2019

The effect of the ongoing breach in the weir is that normal flow in the river Blackwater does not spill over the weir. Instead, the flow in the river is directed through an increasingly narrow section of channel between the Mill Race Weir Wall and O'Neill Crowley Quay before passing through the breach in the weir. The velocity of flow within this narrow channel is very high and is almost always in excess of 2m/s. This resultant turbulent flow has contributed to the progressive nature of the breach and to the ongoing erosion of the river bed alongside O'Neill Crowley Quay and of the river bank at Mill Island, threatening the stability of the flood defence infrastructure.

1.4.5. Previous Studies and Reports

TJOC have reviewed a large number of previous studies and reports in relation to the Fermoy Weir and Fish Bypass Channel which were procured in previous years by Fermoy Town Council, Cork Co Co and the OPW. The information currently available for the project is outlined below;

Engineering Reports

1. Proposed Localised Maintenance Works to Fermoy Weir – Report on Planning, T.J. O'Connor & Associates (October 2016).
2. Proposed Localised Maintenance Works to Fermoy Weir – Application to Inland Fisheries Ireland (IFI) to Proceed with the Works in 2016, T.J. O'Connor & Associates (October 2016).
3. Munster Blackwater – Fermoy Weir Status Report, T.J. O'Connor & Associates (May 2018).

Hydrology

1. Munster Blackwater River (Fermoy) Drainage Scheme – Hydrology Report. Report for the Office of Public Works. Babtie Group (2003).
2. Additional Hydrological and hydraulic investigations. Project internal report to OPW. Jacobs Babtie, (2006).

3. Review of the hydrological estimates of the Fermoy Flood Alleviation Scheme, Jacobs (April 2011).
4. Memo – Additional Hydraulic Investigations, DHV (October 2011).
5. South Western CFRAM Study Final Hydrology Report, Unit of Management 18, Mott McDonald (June 2016).
6. South Western CFRAM Study UoM18 Final Hydraulics Report, Mott McDonald (June 2016).
7. Flood Risk Management Plan River Basin (18) Blackwater (Munster).

Archaeology

1. Archaeological Assessment Report – Fermoy South Drainage Scheme, Daniel Noonan Archaeological Consultancy (September 2010).
2. Underwater Archaeological Impact Assessment Munster Blackwater River – Fermoy South Drainage Scheme, Laurence Dunne Archaeology for Daniel Noonan Archaeological Consultancy (February 2011).

Ecology

1. Ecological Assessment of Likely Significant Impacts of Proposed Repairs to the Fermoy Weir Fish Pass, Pascal Sweeney (November 2012).
2. Likely Significant Impacts of a Proposed Fish Bypass Channel at Fermoy Weir – Screening Statement and NIS, Pascal Sweeney (July 2014).
3. Ecological Assessment of Likely Significant Impacts of Proposed Rehabilitation Works to the Fermoy Weir, Pascal Sweeney (August 2017).

Fisheries

1. Draft Report on Conceptual Design Criteria for Proposed BPC and Smolt Pass Fermoy Weir, River Management Solutions (October 2013).
2. Engineering Report: Proposed Bypass Channel at Fermoy Weir, Department of Environment, Community and local Government (January 2012).

Surveys

1. Topographical Survey, Murphy Surveys (August 2018).
2. Weir Condition Survey, T.J. O'Connor & Associates (November 2018).

1.5. Protected Weir & Blackwater SAC

1.5.1. Protected Status of Existing Weir

The Planning and Development Act 2000 refers to architectural heritage as structures "of special architectural, historical, archaeological, artistic, cultural, scientific, social or technical interest".

The weir in the river Blackwater and the adjacent limestone quay wall at O'Neill Crowley Quay were included in the Fermoy Record of Protected Structures in the Fermoy Development Plan (2010-2016) with Registration No. 02 and described as "*River Blackwater - Weir (sic)and Limestone Quay Wall (Map 5)*". Map 5 is a map, included in the reference plans in the Fermoy Development Plan (2009-2015), showing the location of

protected structures in Fermoy. An extract from Map 5 showing the location of Reg No 02 is reproduced at Figure 1-16. A Variation was made to the Fermoy Town Development Plan 2010-2016 to delist the limestone quay wall in order to facilitate the OPW's Flood Relief Works. The protected status of the weir was not affected by this variation.

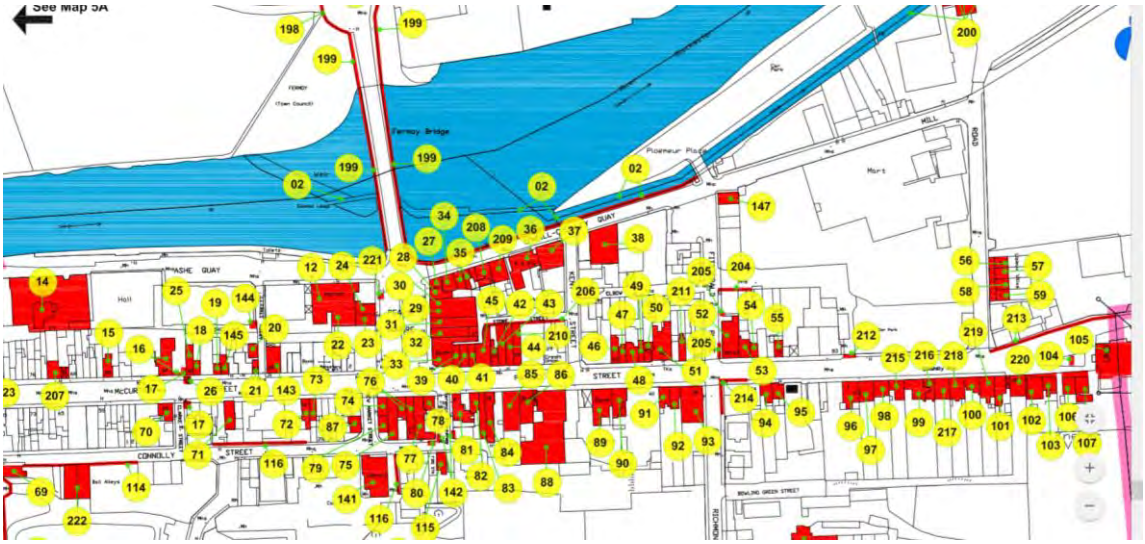


Figure 1-16: Protected Structures in Fermoy

** Reg No 02 River Blackwater -Weir and Limestone Quay Wall*

Works that materially alter a protected structure require planning approval, irrespective of any applicable exemptions, if the works would affect the character of the structure or any element of the structure that contributes to its special architectural, historical, archaeological, artistic, cultural, scientific, social or technical interest.

1.5.2. Designated Special Area of Conservation

The weir is located in the Blackwater river within the Munster Blackwater Special Area of Conservation (SAC). This adds to the difficulty of carrying out any remedial works to the existing weir as it has to be demonstrated through Appropriate Assessment (AA) and a Natura Impact Assessment (NIS) as necessary, that the works will not negatively impact the conservation objectives or have significant adverse effects on the integrity of European sites.

The River Blackwater is one of the largest rivers in Ireland and drains a significant area of Co. Cork and five mountain ranges. The Munster Blackwater SAC (002170) site is a SAC selected for habitats and/or species listed on Annex I / II of the E.U. Habitats Directive which consist of;

- Estuaries
- Tidal mudflats and sandflats
- Perennial vegetation of stony banks
- Salicornia mud
- Atlantic salt meadows

- Mediterranean Salt Meadows
- Floating River Vegetation
- Old Oak Woodlands
- Alluvial Forests (priority)
- Freshwater Pearl Mussel
- White-clawed Crayfish
- Sea Lamprey
- Brook Lamprey
- River Lamprey
- Twaite Shad
- Atlantic Salmon
- Otter
- Killarney Fern

The River Blackwater is of considerable conservation significance due to the occurrence of good examples of habitats and populations of plant and animal species that are listed on Annexes I and II of the E.U. Habitats Directive respectively. In addition, the importance of the site is enhanced due to the presence of a range of uncommon plant species.

The Conservation Objectives report for the Muster Blackwater identifies that artificial barriers block upstream migration for fish species including Atlantic Salmon, Twaite Shad, Sea lamprey and River Lamprey, thereby limiting species to lower stretches and restricting access to spawning areas. In the case of Brook Lamprey these barriers also block downstream migration, thereby possibly limiting species to specific stretches and creating genetically isolated populations. Large weirs on the Blackwater may delay salmon upstream migration in certain water conditions but do not generally prevent access to spawning areas. However, in the case of Twaite Shad, large weirs may prevent potential exploitation of adult spawning grounds.

Given the distance from the proposed development site, the robust nature of estuarine habitats and the dilution provided in the estuarine environment, no adverse effects on Tidal mudflats and sandflats, Perennial vegetation of stony banks, Salicornia mud, Atlantic salt meadows and Mediterranean Salt Meadows is likely to occur. Similarly, no adverse effects on old oak woodlands (terrestrial habitat) and Killarney Fern (terrestrial species) are likely to occur. Notwithstanding that potential effects on these habitats will be assessed by the AA process, the primary concerns in relation to this proposed development are likely to be the aquatic species (Freshwater Pearl Mussel, White-clawed Crayfish, Sea Lamprey, Brook Lamprey, River Lamprey, Twaite Shad, Atlantic Salmon and Otter and two habitats that could be potentially affected, namely, alluvial woodland and Floating River Vegetation.

It is noted that there are other European sites for which potential adverse effects could occur. This includes the Blackwater Callows SPA. However, effects on other European sites are unlikely given the distance of same from the proposed works and the nature of these sites.

The Planning & Development Act states that development which is normally exempted development will require planning permission if it consists of or comprises the excavation, alteration or demolition of places, or sites of ecological interest, the preservation of which

is an objective of the development plan for the area in which the development is located. The same applies in respect of development of a class which would require Environmental Impact Assessment.

Any proposals which will be advanced based on this Options Report will be subject to AA Screening and EIA Screening.

2. RIVER BLACKWATER – HYDROLOGY

2.1. Munster Backwater Fermoy Drainage Scheme

In the past Fermoy was severely affected by flooding from the River Blackwater. The OPW delivered the Munster Blackwater Fermoy Drainage scheme in two contracts between 2009 and 2014. In these contracts, works were completed on both the north and south banks of the river.

Extensive hydrological studies were commissioned by the OPW to inform the design of the Fermoy Flood Defence Scheme. Flood estimates were derived for Fermoy for the eight historical events between 1980 and 2002 using a model which routed flows measured at Killavullen (Babtie 2003). These flood estimates were reviewed in 2011 by Jacobs and DHV to take account of discrepancies that were identified between observed and predicted flood levels in Fermoy.

Following the construction of the Fermoy North and South Drainage Schemes, the OPW undertook some model calibration surveys. However, the hydraulic model was not updated to reflect post construction. The original model included pre-and post-construction scenarios.

Further modelling may be required in the event that options under consideration involve the diversion of flows or significant alterations to the weir level. It should be noted that some of the options considered in Section 4 involve altering the level of the existing weir. Furthermore, the deterioration and subsequent breach of parts of the weir in recent years has led to the flow regime being altered. As a consequence of this, the flow is now concentrated at Mill Race which has resulted in significant erosion as discussed in Section 1. The current flow regime and its consequences will need to be assessed as part of any further modelling proposed.

The OPW commissioned a 1-D Hydraulic model of the Blackwater at Fermoy for the South West CFRAMS Study. The OPW have provided a copy of this model to facilitate any hydraulic assessments for the detailed design of the proposed weir remediation and Fish Bypass channel. The OPW will require that any proposed modification to the weir and any works within the flood plain will not result in any increased flood risk at Fermoy.

2.2. Design Flows

The South West CFRAMS Unit of Management 18 Hydrology report (2016) provides design flows for the river Blackwater downstream of Fermoy Bridge which were used for the production of the CFRAMS flood maps. These design flows or a range of different flood events are shown in Table 2-1 below.

Table 2-1: UoM18 Design Peak Flood Flows at Fermoy

HEP ID	Gauge/ Ungauged Location	50% AEP	20% AEP	10% AEP	5% AEP	2% AEP	1% AEP	0.5% AEP	0.1% AEP
18_1158_5	Fermoy Bridge Downstream 18107	370 m^3/s	499 m^3/s	585 m^3/s	667 m^3/s	773 m^3/s	853 m^3/s	933 m^3/s	1117 m^3/s

The OPW maintains a number of staff gauges in the vicinity of Fermoy Weir. These gauges are referenced at Table 2-2 below;

Table 2-2: River Level Gauges at Fermoy

Gauge reference	Location
18124	Fermoy U/S Rowing Club
18106	Fermoy Bridge U/S
18107	Fermoy Bridge D/S
18117	Fermoy Mill

The catchment area upstream of gauge 18107, Fermoy Bridge D/S is 1,750km^2. The OPW's Hydrodata website records statistics for gauge 18107 are reproduced at Table 2-3 below.

Table 2-3: Flow Duration Statistics for Station 18107 at Fermoy

DURATION PERCENTILES								
Flows equalled or exceeded for the given percentage of time (m3/s) (Data derived for the period 2001 to 2019)								
1%	5%	10%	25%	50%	75%	90%	95%	99%
254.273	146.374	96.979	46.773	22.284	13.725	9.857	8.579	6.125
Levels equalled or exceeded for the given percentage of time (mAOD Poolbeg) (Data derived for the period 2001 to 2019)								
1%	5%	10%	25%	50%	75%	90%	95%	99%
24.45	23.626	23.168	22.63	22.283	22.134	22.061	22.023	21.968

Inland Fisheries Ireland have confirmed that, in accordance with the "Guidelines on the Planning, Design, Construction & Operation of Small-Scale Hydro-Electric Schemes and Fisheries", DCENR, 2007, the flow that must be available to the fish for passage etc. is *"Compensation flow provision of 12.5% of the long term mean flow (Q_m) or 50% of the available flow upstream of the intake point, whichever is the greater".*

The long-term average flow for the River Blackwater is not recorded for any gauge at Fermoy. However, The Department of Housing previously advised that the long term mean flow Q_m at Fermoy was 47.4m^3/s. Therefore, 12.5% of Q_m corresponds to 5.925m^3/s. The 95%ile flow is recorded above as 8.579m^3/s.

3. PLANNING CONSIDERATIONS

As noted in Section 1.5, works that materially alter a Protected Structure require planning irrespective of any planning exemptions. The same applies in respect of development which requires an Appropriate Assessment (AA) or is of a class which would require Environmental Impact Assessment (EIA).

Therefore, development is not classified as exempt if it;

1. Impacts on a protected structure.
2. Requires an appropriate assessment.
3. Requires an environmental impact assessment.

This Options Report is a preliminary consideration of the potential options to satisfy the project objectives. Before any proposal is advanced to detailed design and submitted for planning approval, it must be subjected to AA Screening and EIA Screening.

3.1. Appropriate Assessment Requirements

Article 6(3) of *Council Directive 92/43/EEC of 21 May 1992 on the Conservation of Natural Habitats and of Wild Fauna and Flora* (as amended) ('the Habitats Directive') requires that, any plan or project not directly connected with or necessary to the management of a designated site, but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subject to appropriate assessment of its implications for the site in view of the site's conservation objectives.

The possibility of there being a significant effect on a designated or "European" site, if identified as a result of Appropriate Assessment Screening, generates the need for an Appropriate Assessment to be carried out by the competent authority for the purposes of Article 6(3). A Stage Two Appropriate Assessment is required if it cannot be excluded, on the basis of objective information, that the proposed development, individually or in combination with other plans or projects, will adversely affect the integrity of any site concerned. The first (Screening) Stage for appropriate assessment operates merely to determine whether a (Stage Two) Appropriate Assessment must be undertaken on the implications of the plan or project for the conservation objectives of relevant European sites.

However, Cork County Council, as the developer for this project, cannot carry out an Appropriate Assessment for its own project. If a Stage One screening confirms that a Stage Two Appropriate Assessment is required, data and information on the project and on the site and an analysis of potential effects on the site must be obtained and presented in a Natura Impact Statement (NIS).

Approval of the NIS is required from An Bord Pleanála (ABP) through the Part XAB planning procedure under section 177AE (relating to Appropriate Assessment) of the Planning and Development Act, 2000, as amended.

3.2. Flood Risk Assessment

A Flood Risk Assessment, in accordance with *"The Planning System and Flood Risk Management – Guidelines for Planning Authorities"*, is required to be submitted to ABP for applications under section 177AE of the Planning and Development Act 2000 as amended.

The flood maps for the area indicate that the development is situated in Flood Zone A, i.e. an area at risk to flooding up to a 1% AEP event. The proposed development, which comprises rehabilitating the existing weir and constructing a new fish bypass channel, are both classified as water compatible development under the above guidelines. These development types are permissible in Flood Zone A without the requirement of a Justification Test.

The OPW will require confirmation that the works proposed for the weir remediation and Fish Bypass Channel do not give rise to an increase in flood risk or flood depth within the flood plain of the River Blackwater and the area covered by the Munster Blackwater Fermoy Drainage Order.

3.3. Topographical Survey

A topographical survey has been carried out on the land located to the west of Fermoy bridge and on the northern side of the river Blackwater, i.e. the area where the fish bypass channel is proposed as discussed in Section 4. The survey also includes an area of land adjacent to the downstream section of the Mill Race end of the weir.

3.4. Additional Third-Party Surveys & Specialist Surveys

Investigations were required to be undertaken in accordance with the project brief for the preparation of proposals and planning documentation for the remediation of Fermoy weir and the provision of a fish bypass channel. These surveys have been advanced although some remain to be completed. The following surveys are required to be completed to support the planning application for the scheme and to support any Appropriate Assessment Screening and Natura Impact Statement.

3.4.1. Underwater Archaeological Survey

An Underwater Archaeological Survey is required to assess the existing weir and determine the extent of it which extends underwater. Mizen Archaeology were appointed in January 2020 to carry out this assessment. However, were unable to commence their dive surveys until the water levels in the river subsided due to the safety considerations associated with the high velocity of flow in the river Blackwater and in the Mill Race channel in particular.

The DAU Manager, in his correspondence of the 28th February 2020 on behalf of the Minister of Culture Heritage and the Gaeltacht, noted that it is intended to engage the

services of an underwater archaeologist to carry out the necessary archaeological assessment for the proposed works. The Minister has advised that the Underwater Archaeological Impact Assessment (UAIA) shall contain the following:

- A detailed underwater archaeological assessment of the weir structure, riverbed, river bank and bridge structure, should the latter also be included in the footprint of the proposed works. The UAIA shall also include assessing the potential impact on underwater cultural heritage of any proposed access and egress routes for plant and machinery into the river, including haul roads, etc.
- The assessment shall comprise visual assessment, including photographic survey of the structures and riverbed and shall be accompanied by a hand held metal detection survey.
- A measured, scaled and geo-referenced drawn and photogrammetric survey of the weir as it currently presents, accompanied by a detailed descriptive record.
- It shall be noted that timbers were identified in the riverbed previously in the proximity of the existing bridge that may form part of earlier structures, either for an earlier bridge or earlier weir or other, previously unidentified feature. The location of the timbers shall be confirmed and if within the footprint of proposed works or any associated works (e.g. for vehicular access to river, etc.) then shall form part of the UAIA assessment.
- A detailed desktop assessment that consults with all known and relevant sources shall inform the UAIA from the outset and shall seek to identify potential for previously unknown underwater cultural heritage to be present in the riverbed so as to enable avoidance of any impact on heritage.
- The desktop study shall consult results of previous UAIAs and other relevant archaeological assessments and shall also include accessing the Topographical files in the National Museum of Ireland and also local sources to include artefactual finds from the River Blackwater in that area. Several finds have been recovered in the past by divers that indicated the potential for more material culture to be present in the underwater environment within the footprint of the proposed works.
- A detailed impact statement shall be included in the UAIA, addressing all propose options for the remediation and repair project, and shall put forward informed recommendations addressing each option to propose avoidance, as the preferred option, or archaeological mitigation of unavoidable impacts on the underwater cultural heritage.

Mizen Archaeology prepared an Underwater Archaeological Impact Assessment which includes a desk top study and the findings of a wade survey which was conducted in May 2020.

3.4.2. Weir Inspection

An inspection of the weir structure was undertaken by Trevor Wood Consulting Engineers (TWCE), who were engaged by T.J. O'Connor & Associates as Conservation Engineers for the project. This involved an inspection on the extent of the breach and assessment of the condition of the remaining section of the weir since the inspection previously undertaken in 2018. The report includes a desktop study, reviewing the findings of previous

relevant studies, similar protected structures and weir remedial works. TWCE undertook site inspections in January and May 2020 and presented recommendations for remediation of the weir, considering three separate elements of the structure – the crump weir section, the existing fish pass and the Mill Race Weir.

3.4.3. Bathymetric Survey

The weir remediation options will entail considering the reuse of masonry blocks from the collapsed section of the weir wall. It will be necessary to ascertain the extent of the debris field from the weir wall collapse in order to confirm the feasibility of the reuse of the stone.

The funnelling of flows through the Mill Race channel in most flow conditions and the associated high velocities may have resulted in changes in the bed profile upstream of the weir. This should be confirmed in order to accurately model the hydraulic conditions for the weir and bypass. In view of this, a bathymetric survey should be completed of the river bed extending a short distance upstream and downstream of the weir structure.

A higher order of survey grid may be required in the immediate vicinity of the breach of the weir to establish the extent of the breach, its base and the extent of the associated debris field. This will be determined when completing the scoping and tender documents for the bathymetric survey.

This information will be required for the detailed design of the recommended scheme and can be progressed in conjunction with that phase of the project.

3.4.4. Survey of Bank Erosion & Bankside Structures

As described above the breach in the weir has led to the main body of flow in the river Blackwater being funnelled through the Mill Race channel. The resultant high velocity of flow has led to erosion and collapse of the river bank at the western end of the Mill Island.

This has led to the loss of almost 15m from the Mill Island along with the associated bankside wall. Trees have been removed to prevent the risk of further damage arising if they were to fall suddenly. A section of the Mill island wall which was reconstructed under the Fermoy South Flood Defence Scheme contract has now been exposed to flow from the side and is at risk of being undermined also.

While there is no immediate threat to the permanent works of the flood defence scheme, the section of flood defence wall in the vicinity of the Mill Island Pumping Station is anchored in the direction of the river. The anchors supporting the piled foundation of the western end of this wall could be at risk of exposure if the flow through the beach continues to erode the downstream river bank.

The OPW is undertaking a review of the impact of river bed and bank erosion on the flood defence assets and will compare current bed levels with original design assumptions for bed levels and identify any potential consequences for design Factors of Safety.

3.4.5. Ecological Surveys

The DAU Manager's letter dated the 28th February 2020 included recommendations from the Minister of Culture Heritage and the Gaeltacht on what should be considered as part of survey work for the NIS and ecological impact assessment.

The Minister has recommended in the correspondence that the following be considered as part of survey work for the NIS and ecological impact assessment:

- Occurrence of alluvial woodland (up to 3km upstream and 2km downstream of weir) – the ecologist is requested to contact the NPWS (regional ecologist) if there are any issues with the interpretation of this habitat type.
- Occurrence of water crowfoot / starwort community (up to 1 km below the weir).
- Presence of freshwater pearl mussel (up to 150m below the weir).
- Presence of white-clawed crayfish (up to 150m below the weir).
- Presence of breeding otter (up to 150m above and below the weir).
- Spawning and juvenile habitat of lamprey species (up to 150m below the weir) - the advice of IFI should be followed in relation to survey and impact assessment for these species.
- Salmon and Twaite shad: The advice of IFI should be followed as to whether these species need to be surveyed.
- Presence of breeding river birds: kingfisher (Birds Directive Annex 1 species), grey wagtail (amber listed species) and dipper (up to 100m above and below the weir).
- Presence of invasive species (e.g. Japanese knotweed, Himalayan balsam, giant hogweed) in works area.

The project ecologist Carl Dixon has engaged the services of an aquatic specialist, Ross Macklin, who is familiar with Freshwater Pearl Mussel surveying techniques, with Twaite Shad and also with eDNA monitoring for fish species, as may be required for Twaite Shad.

The Minister has recommended that any NIS that might be required should include proposals for monitoring the efficacy of the proposed fish pass, particularly in relation to Twaite Shad access and has suggested that eDNA could be considered. An investigation of eDNA for Twaite Shad in the River Blackwater from Fermoy to the upper tidal reaches of the Blackwater Estuary at Cappoquin has been undertaken.

3.5. Stakeholders

There are a number of statutory, non-statutory, local organisations, potentially affected landowners as well as the general public that have been identified by Cork County Council as stakeholders in the development and implementation of the scheme.

A Stakeholder Management Plan has been developed for the project. The relevant stakeholders identified to date are included in the stakeholder management plan.

Consultations have already been conducted with NPWS, Inland Fisheries Ireland, Cork County Council (CCC) Architectural Conservation Officer, CCC Ecologist and CCC

Archaeologist. The Engineering Inspector of the Water and Marine Advisory Unit, Department of Housing, Planning, Community & Local Government was in attendance at the consultation with Inland Fisheries Ireland.

Further stakeholder consultations will be arranged with relevant stakeholders to establish any specific comments and feedback they may have and where possible to accommodate same in the detailed design of the works.

The views and opinions of the public and relevant stakeholders will be invited before commencing preparation of a planning application and associated environmental studies and assessments for a scheme to provide for the remediation of Fermoy Weir along with the provision of a fish bypass channel at Fermoy.

The stakeholder management plan will be used as a means of documenting any conversations, meetings, agreements, etc. with all relevant stakeholders identified. This will ensure that any agreements, required changes or amendments to the proposed project works or any accommodation works that may be required by stakeholders, are documented, recorded and tracked as the project develops and progresses through the different stages.

3.6. Arterial Drainage Consents

Approvals from the Office of Public Works may be required in respect of three aspects of the Arterial Drainage Act. These are as follows;

1. Section 9 (channel) of the Arterial Drainage (Amendment) Act 1995 which provides that the Commissioners of the OPW may consent to alterations to existing watercourses or structures in Drainage Schemes if the proposed works would not increase the risk of flooding or have a negative impact on the drainage of land. This section will apply given the location of the weir within the Fermoy Drainage Scheme. The OPW advise that applications under Section 9 are dealt with on a case by case basis.
2. Section 47 (weir) of the Arterial Drainage Act 1945 which requires that any person planning to erect or alter a weir must first get consent from the Commissioners of the OPW or all the affected landowners. The Commissioners may grant consent only where the applicant meets stringent requirements.
3. Section 50 (bridge) of the Arterial Drainage Act 1945 and the EU (Assessment and Management of Flood Risks) Regulations, SI 122 of 2010, which states that the consent of the Commissioners of the OPW is required by bodies and persons proposing to carry out construction/alteration works on bridges and culverts. Although the modification or remediation of the weir in the vicinity of the piers is likely to be minimal, it may be necessary to complete a Section 50 application to the OPW.

3.6.1. Munster Blackwater Drainage Scheme Minutes of 05/12/19

The consents required for the proposed weir repairs and fish bypass works were discussed with the OPW by a TJOC staff member who was involved in the scheme. The OPW clarified the following in regards to Section 9, Section 47 and Section 50 consents;

1. Section 9 (channel) – The OPW clarified that if the conveyance capacity of the channel is not being affected then there is no issue. They also advised if the weir is simply being repaired to the same profile and cross-section as assumed in the Flood Scheme models, then an engineer's opinion that no approval is required should be submitted to that effect.
2. Section 47 (weir) – The OPW clarified that if there is no cause of additional flooding, no consent would be needed but this would require the opinion of the OPW's engineers and would also need to be justified by modelling if required. However, if the weir is being reinstated to the levels assumed in the Fermoy Flood Scheme models then this would demonstrate the principle.
3. Section 50 (bridge) – The OPW advised that if the new fish bypass is not changing the flows through the bridge then no consent will be required. The OPW also noted that this may be more an issue for TII to consider if there are any potential scouring effects on the bridge supports.

3.7. Other Requirements & Constraints

3.7.1. Water Framework Directive

The EU Water Framework Directive is environmental legislation that aims at improving the water environment and requires governments to take a holistic approach to managing their countries' waters. The legislation applies to rivers, lakes groundwater, estuaries and coastal waters. Under the legislation, each member state was required to aim to achieve "good" status in all waters by 2015 and must ensure that no water status deteriorates.

River Basin Management Plans (RBMPs) have been produced for each River Basin District in Ireland in line with the requirements of the Water Framework Directive. The WaterMaps viewer, which forms part of the RBMP, provides information on a selected watercourse including its status, risks, objectives, and measures proposed to retain or improve its status as appropriate.

The RBMP report for the Blackwater waterbody, IE_SW_18_2292_6, illustrates that the overall status of this reach of the river is considered to be "poor", i.e. condition of the water as defined by the chemical and ecological status (whichever is worse). The overall objective for the waterbody is to "restore" the status of the river to "good" status by 2021. The waterbody is also considered to be at risk of not achieving "good" status by 2021 due to the various pressures such as diffuse risk sources, hydrological risks and morphological risks acting on the waterbody as detailed in the RBMP report.

The Blackwater waterbody at Fermoy is not considered to be "Heavily Modified". A waterbody is considered to be heavily modified if there are a significant number of weirs or modifications to the natural watercourse, i.e. alterations by human activity, which

substantially change the character of the water body to the extent where it cannot achieve "good" ecological status. The RBMP report for the Blackwater waterbody at Fermoy also notes that impoundments on the river are not a risk to the waterbody achieving good ecological status.

3.7.1. OPW Flood Embankments

The OPW maintains the flood embankment situated on the northern side of the river, adjacent to where the fish bypass channel is proposed in a number of the options considered in Sections 4 and 5 below. This embankment forms part of the Fermoy North Flood Defence Scheme. The OPW's requirements will relate to the integrity of the embankment that may be affected by fish bypass works proposals in the vicinity due to any reduction in the groundwater flow path that would occur from constructing the fish bypass in the bank of the river. Any proposed fish bypass channel in the northern bank of the river will be required to demonstrate that the effects on the flow path will not be impacted to the extent that the flood embankment will be compromised.

3.7.2. Rowing Club

Fermoy rowing club requires that the water level on the upstream side of the weir is maintained so as not to impact on their rowing activities. Therefore, any proposed option that would impact on the upstream water level in the river would not be acceptable from the rowing club's perspective. Maintaining the upstream water level must be a consideration when considering the viability of each option.

Although there is no legal basis for maintaining the upstream water level, if the proposed works significantly reduced the current upstream water levels, this would have a negative impact on the amenity and leisure use of the river. CCC have advised that the upstream water level will need to be maintained as part of the works to facilitate the rowing club's requirements.

4. REVIEW OF OPTIONS

4.1. Options Considered

4.1.1. Weir Remediation

As noted in Section 1.4.3, the weir, which dates back to the early 19th Century, was constructed originally of masonry and rubble and a concrete capping and apron was placed over it in the 1970's. The weir is a protected structure and, consequently, best conservation practices should be adopted for any remedial works. The Conservation Engineers report states that the main ethos of conservation is to retain as much of the existing fabric as possible and keep interventions to a minimum.

Options for remediating the weir were discussed with Cork County Council's Architectural Conservation Officer to identify any constraints to the works and to determine acceptable / preferred methods of remediation from a heritage perspective. A meeting to discuss the options was held on 30th January 2020 with CCC's Architectural Conservation Officer.

The options that were considered and discussed during the meeting were;

1. Mitigation by design, i.e. reconstruction using original materials.
2. Mitigation by record, i.e. record and replace with new.

The solution agreed at the meeting for remediating the weir was mitigation by design, where possible. It was agreed that the materials to be used for remediation are to consist of the existing masonry and rubble where possible. CCC's Architectural Conservation Officer acknowledged that the weir serves a design function and is not simply an aesthetic feature. In view of this, the Conservation Officer also agreed that new masonry, closely resembling the existing masonry, such as locally sourced limestone and sandstone, could also be used if necessary when rehabilitating the weir subject to the approval of the Architectural Conservation Officer.

4.1.1.1 Conservation Engineers Report

TWCE, the conservation engineers advising T.J. O'Connor & Associates, carried out inspections of the existing weir on 30/01/20 and 20/05/20. Significant rainfall occurred in the days leading up to the first inspection which resulted in higher levels been observed in the river. During the first inspection, TWCE observed the following;

- The main breach on the eastern end of the weir appeared to have increased in size since the photos taken in December 2019.
- The main embankment (Crump) section of the weir, i.e. the section of weir which extends from the northern river bank on the western side of Fermoy bridge to the Mill Race section, has limited flow spilling over it due to the breach passing the majority of the flow which in turn is reducing water levels at the crump weir section.
- The only section where noticeable flow was observed over the crump weir section was close to the fish pass section on the southern side.

As a result of the high river levels, a further inspection was carried out at a time when the river levels were significantly lower in May 2020. The water levels were such that a closer inspection was possible for the majority of the weir apart from the immediate vicinity of the breach.

Two types of stonework were identified in the Mill Race weir section. The base layers are limestone surmounted by a section composed of sandstone, topped with limestone. Significant washout of fill material was evident. The breach in the weir was observed to have extended into the adjacent ground where flood relief works were undertaken.

The concrete capping on the crump weir was observed to have been a later intervention which in the opinion of the conservation engineer was a contributory factor to the undermining of the toe of the crump weir due to its relative smoothness compared to the randomly placed stonework.

The original fish pass walls, base and steps are formed from cut limestone blocks. A concrete cap and plug, with a pipe inserted, was visible at all of the steps in the fish pass. This is identified as a later intervention as are some repair works, undertaken following a collapse of a section of side wall of the fish pass, where steel sheet piling and timber infill panels have been inserted. The conservation engineer recommends that both these interventions should be removed as part of the remediation.

4.1.1.2 Remediation of Crump Weir Section

The conservation engineer's initial recommendations for remediating the crump section of the weir is to remove the concrete apron and reset the limestone setts with the addition of random rubble fill (similar to the existing) where required. The concrete apron which was placed in the 1970's has the effect of increasing velocities on the downstream face of the weir leading to scour at the toe of the weir. A high tensile geotextile is also proposed to be introduced to assist in reducing wash out of the fill. At both the upstream heel and downstream toe of the crump weir section, the undercut / missing stonework is proposed to 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 is to 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.

4.1.1.3 Remediation of Mill Race Weir Section

TWCE's initial recommendations for remediating the mill race section of the weir involve reconstructing the breached sections with existing stonework or new stonework to closely resemble 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 would 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 would be removed, the wall raised and the capping reset to a remediated level higher than the adjacent Crump weir, with a level of 21.55mOD proposed.

Prompt is also referred to as natural cement, in which the description “natural” indicates that the raw material, a type of limestone known as clayey marl, is simply mined and burnt with no further additions. Portland and other “artificial” cements are produced from a man-made mixture of pure limestone, silicates and clays in a controlled, reproducible manner.

The bank and walls downstream of the weir at Mill island have been severely eroded since the breach in the weir. This area must also be reinstated to its original bank line.

4.1.1.4 Remediation of Existing Fish Pass

The initial recommendations for remediating the existing fish pass include removing the temporary remedial works previously carried out and reconstructing this section of the side wall with new limestone to match the existing masonry. The remaining sections of the fish pass side walls would then be pointed with natural cement. Other missing stonework would be replaced and any out of position stonework would also be reset.

Should the existing fish pass need to be decommissioned, it is proposed that this could be achieved by constructing stonework across the upstream entrance of the fish pass to the same height of the stonework on the rehabilitated side walls. The diversion of flows from the fish pass should extend to include the flow which runs down the south side of the fish pass resulting in considerable erosion of the weir face where the flow is funnelled by the diagonal orientation of the existing fish pass. The downstream end of the fish pass would also need to be blocked/infilled to prevent fish from trying to navigate the pass.

4.1.2. Fish Bypass Channel

Options for a proposed fish bypass channel were previously developed in 2014 and were discussed with IFI at the time. 4 No. options were developed and considered over a number of years (details reproduced at Appendix B). These comprised options 3,5,7 and 9 in the list of options below. A meeting was held with the National Parks and Wildlife Services (NPWS) on 10th February 2020 and further options (1,2 4 and 6) were identified by the NPWS for consideration. Option 8 was suggested by the Department of Housing.

1. Do-nothing;
2. Do-nothing except for stabilising the existing weir;
3. Remediate the existing fish pass;
4. Remove the weir in its entirety;
5. Construct an in-river rock ramp;
6. Construct a rock ramp in the existing breach;
7. Construct a near natural bypass channel.
8. Bypass the river around the weir
9. Construct a rough channel pool bypass.

Drawings and sketches illustrating the proposals for the above options are included in Appendix C with further details on the options also provided below.

4.1.2.1 Option 1 – Do Nothing Scenario

The do-nothing option, as the name suggests, involves leaving the existing situation as is. This will not facilitate free passage of fish species listed as qualifying interests for the Blackwater River SAC. Current speeds are too fast to facilitate upstream movement of qualifying interest fish species and is unable to meet the requirements of IFI in terms of providing fish passage for fish of all species. Similarly, 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.

This option would also not be acceptable from an architectural conservation perspective as the weir, which is a protected structure, would continue to deteriorate. Cork County Council, as the owner of the protected structure, is legally required to make sure that the structure does not become endangered through neglect, decay, damage or harm. This option would, in effect, involve Cork Co Co ignoring its obligations under Part IV of the Planning and development Act, 2000.

4.1.2.2 Option 2 – Stabilise Remaining Section of Existing Weir

This option is similar to the do-nothing scenario described in Option 1, except that it would involve works to stabilise the existing weir to prevent further deterioration, while leaving the breach in the weir.

This option would meet the conservation objectives of the SAC only if it is able to provide for free passage to fish species listed as qualifying interests for the Blackwater SAC. Similar to Option 1, 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. This would give rise to continued erosion of the river bed and banks.

This option would not meet the architectural conservation objectives for the protected weir. The approach envisaged in this option would not allow the “restoration of character” of the weir. It would also negatively impact the established leisure and amenity uses upstream of the weir. Rowing regattas have had to be cancelled since the breach formed in the weir due to inadequate depth of water upstream of the weir.

4.1.2.3 Option 3 – Remediate Existing Fish Pass

This option consists of repairing the existing fish pass. The existing fish pass is a technical type fish pass, comprising a masonry stepped structure located within the weir structure close to the midpoint of the river. The fish pass crosses the weir on a diagonal to decrease the gradient and increase the number of steps in the structure. Damage to the lower part of the structure was repaired in 2013. Since then further damage has occurred and part of

the side wall of the pass, on the downstream facing side of the structure, has been breached.

Figure 4-1: Existing Fish Pass at Fermoy Weir - November 2019

It had been proposed to retain the upper section of the fish pass structure and demolish and replace the lower section with a new in-situ concrete structure. A new channel was proposed to be created in the river bed to create an attraction flow in the river at the entrance to the fish pass.

IFI have advised that the location of the existing fish pass is contrary to basic fish pass design guidance. Guidance advises that the entrance should be located where migrating fish naturally congregate which is generally as far upstream along a weir structure as possible. The existing fish pass entrance is halfway along the weir and is too far downstream to be found by all migrating fish. In addition to this, the entrance will not ensure the free run of all fish at all periods of the year.

Furthermore, the orientation of the fish pass is also unsuitable and does not conform to basic fish pass design guidance which states it should be perpendicular to the weir and parallel to the water flow on the weir.

IFI advised that the fish pass is required to provide passage for all fish species listed as Annex II species within the Habitats Directive which, for the river Blackwater, consist of Atlantic Salmon, sea, river and Brook Lamprey and Twaite shad. IFI also advised that the fish pass is also required to provide passage at all times, to the above species, irrespective of flow conditions. This would not be achievable with an upgrade of the existing fish pass. In addition to this, remediating the existing fish pass would not satisfy the relevant requirements of the Fisheries Consolidation Act, the Water Framework Directive or the Habitats Directive.

4.1.2.4 Option 4 – Complete Removal of Existing Weir

The last option identified by NPWS for inclusion in the analysis is the complete removal of the existing weir. While this option would satisfy the conservation objectives of the SAC, and would also provide for the passage of all fish due to the elimination of the barrier, it would not be acceptable from an architectural conservation objective as the existing weir is a protected structure.

As previously stated, Cork County Council, as the owner of the protected structure, is legally required to make sure that the structure does not become endangered through neglect, decay, damage or harm. This option would, in effect, involve Cork Co Co ignoring or reneging on its obligations under Part IV of the Planning and Development Act, 2000.

This option would result in a significant lowering of water levels in the reach of the river upstream of where the weir is situated which would extend for several kilometres upstream.

Riverbank habitats could be permanently affected by the lowering of the water level if the weir was removed. Construction impacts could include the requirement for instream works to remove the rubble and masonry structure resulting in the risk of silt generation and disturbance of adjacent instream habitats. There is also a risk that silt, accumulated over many years at the upstream side of the weir, could be released downstream during the demolition and removal of the weir structure. This could impact on aquatic species listed as qualifying interests for the Blackwater River SAC including Freshwater Pearl Mussel which are particularly susceptible to increased silt levels. Whilst it is noted that the complete removal of weir would facilitate movement of fish listed as qualifying species for the Blackwater River SAC, such movement of fish can be facilitated by the engineered solutions discussed above.

The complete removal of the existing weir would significantly impact on the amenity uses of the river upstream of Fermoy Bridge and would negatively impact the existing amenity uses for that stretch of the river. Rowing activities in particular would suffer adversely due to the permanent lowering of water in this reach of the river.

4.1.2.5 Option 5 – Construct an In-River Rock Ramp

This proposal comprises constructing a rock ramp, approx. 62m long x 30m wide in the river Blackwater on the western side of Fermoy bridge alongside the north bank of the river. This option also involves raising the weir crest level to form a height of 21.50mOD throughout. Dredging of an area of the river bed of approx. 350m^2, downstream of the weir, would also be required as part of this option. The rock ramp would be integrated directly in the weir construction.

The bed of the ramp would comprise rockfill in which large boulders or boulder sills would be arranged to form cascades providing the water depths and flow velocities required to allow upstream migration of fish. These boulders and sills would also serve to create shelters, deep zones and resting pools along the length of the ramp. A bed slope of 1 in 30 approximately was proposed to satisfy these requirements. The ramp would have to be separated from the retained section of weir by a vertical dividing wall.

The proximity of Fermoy Bridge to the weir dictates that the rock ramp would have to be largely located upstream of the existing weir. If the ramp extended downstream it would interfere with the bridge pier.

The development of a rock ramp would facilitate movement of migratory fish species listed as qualifying interests for the Blackwater River SAC (Sea Lamprey, River Lamprey, Twaite Shad and Atlantic Salmon and downstream movement of Brook Lamprey). However, the proposed location of the new rock ramp would require removal of a significant section of the weir which is a Protected Structure.

4.1.2.6 Option 6 – Construct Fish Ramp (Rock Ramp) in Existing Breach

This option proposed by NPWS consists of constructing the new fish ramp in the existing breach in the weir. However, it would not be ideally situated for fish passage because the breach is located at the downstream end of the weir. Ideally, fish passage should be provided for at the furthest upstream point on the obstruction.

In the case of Fermoy weir, the furthest upstream point is located alongside the north bank. The breach in the weir is located alongside the south bank at the furthest downstream point meaning the new fish ramp would not be ideally located for fish passage.

4.1.2.7 Option 7 – Construct a Near Natural Bypass Channel

This option consists of constructing a meandering, near natural, bypass channel which would be situated in the northern bank of the river Blackwater, west of Fermoy bridge. This option would have the added benefit of being able to construct the bypass predominantly from land which would significantly reduce the extent of instream works and the subsequent impact on the SAC.

The term 'bypass channel' is used for fish passes that bypass an obstacle and that are in the form of a natural-looking channel that mimics a natural river. This proposal would require no structural alterations to the weir structure itself other than those required for the remediation of the weir. Only a portion of the flow would be diverted through the bypass channel.

A near natural bypass channel as proposed for Fermoy would receive approximately 15% of the upstream flow and would have an average longitudinal gradient of 1:30 approximately and a channel width varying between 8 and 12 metres.

Resting pools are incorporated for fish at two locations in this option.

Inland Fisheries Ireland (IFI) expressed concern that a near natural fish bypass channel would not satisfy the requirement for passage of migratory fish species listed as qualifying interests for the Blackwater River SAC and does not meet the IFI requirement for conveyance 50% of the mean flow.

4.1.2.8 Option 8 – Bypass River around weir

A variation of Option 7 was also considered, which consists of utilising the proposed bypass channel to divert all of the flow around the existing weir. This alternative option would eliminate the need for a rock ramp. Although this option would be substantially cheaper, it would still require significant land acquisition, bank protection measures on the new channel and would not avoid the costs associated with the remediation of the weir. However, the water level in the reach of the river upstream of the weir would be reduced if this option was implemented.

When the weir was intact there was a 2.2m difference in water levels either side of the weir. Allowing all flow to bypass the weir structure without controls would result in a drop in water level on the upstream side of the weir in the range 1.0m to 1.5m. The impact of this drop in water level would continue to be experienced several kilometres upstream. This would have a negative effect on the conservation objectives of the SAC such as alluvial woodland and would not be considered acceptable by the NPWS.

This option would not accommodate the requirements of Fermoy rowing club as it would significantly impact on their rowing interests due to the decreased water levels in the river. The weir would also become permanently dry with this option as all of the flow would be diverted through the new bypass channel.

4.1.2.9 Option 9 – Construct a Rough Channel Pool Bypass

Option 9 consists of constructing a curved rock (rough channel pool) ramp type of bypass in the northern bank of the river Blackwater, west of Fermoy bridge. The rock ramp would provide a ladder for fish migrating upstream and resting pools would be created by the varying levels of rock weir walls.

The Fish Passes Design, Dimensions, Monitoring Guideline published by the FAO and DVWK (2002) describes a rough-channel pool pass as a combination of a technical fish pass and a fish ramp, in which the pool cross-walls are substituted by columnar rocks set on edge. This arrangement allows appreciably greater water depths to be obtained and a steeper slope (up to maximum 1:10, although 1 in 35 is proposed for Fermoy) to be used than with conventional fish ramps. A decisive feature in this case is that the differences in water level between the pools must not exceed h = 0.2 m, to maintain the maximum permissible flow velocities of v_{max} = 2.0 m/s.

Large, slender boulders (quarry-stones), embedded in the bottom rockfill layer of the pass, will be used to build the transverse bars as shown in Figure 4.2. The boulders will be embedded in approximately 0.4 m in the rockfill bottom. The boulders must be embedded in such a way that water only flows around them, and not over them. The clear width of the opening between the boulders should not be less than 0.20m, to enable larger fish to ascend and to reduce the risk of clogging with debris.

The boulders must be offset in both the longitudinal and the transverse directions to allow the discharge to better fan-out and for better dissipation of energy in the pools. The discharge jets should always impinge on a boulder of the next transverse bar downstream and should not shoot through the next bar in order not to form a short-circuit current.

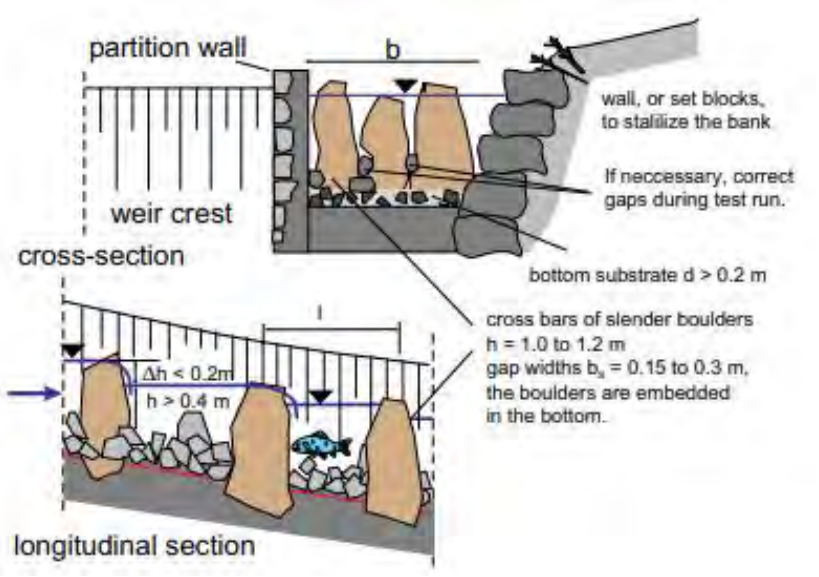


Figure 4-2: Rough Channel Pool Pass Details

This option will facilitate free movement of migratory fish species listed as qualifying interests for the Blackwater River SAC (Sea Lamprey, River Lamprey, Twaite Shad and Atlantic Salmon and movement of Brook Lamprey).

4.2. Assessment of Options

The following sections set out the assessment of each option. The options have been assessed relative to the legal requirements to protect the SAC and its qualifying interests, as set out in the Habitats Directive, and relative to the potential of satisfying the primary project objectives of weir remediation and providing for fish passage in all circumstances.

4.2.1. Option 1 – Do-Nothing

The do-nothing option would involve leaving the current situation as it is at present. This would allow the weir to further deteriorate to the point of complete collapse which would be contrary to the project objectives. It is likely that the weir would further deteriorate rapidly as suggested by the photos in Figures 1-12 and 1-13 where significant damage was sustained to the weir over a relatively short period of time.

Complete collapse of the weir would allow for the free passage of migrating fish upstream, albeit at the expense of the weir which is designated as a protected structure. However, this could take an extremely long period of time to fully occur. This option would, in effect, involve CCC ignoring its obligations under Part IV of the Planning and Development Act, 2000.

Complete collapse of the weir over time would also affect the upstream water levels which, in turn, would affect leisure and amenity activities and potentially the conservation objectives for alluvial woodland which is listed as a qualifying interest for the Blackwater River SAC. The release of silt which may have accumulated upstream of the weir could have effects on other aquatic qualifying species, including white clawed crayfish, brook lamprey, otter (via impacts on prey availability), freshwater pearl mussel and the habitat, floating river vegetation.

The do-nothing option would not have any visual impacts in the short-term. However, the medium-term visual impact would be a highly visible semi derelict structure in the river. The long-term impacts would be that the weir would no longer be visible on the river as a result of prolonged deterioration and collapse. It is also understood that there are various groups and petitions that have been formed for the sole purpose of preserving the existing weir at Fermoy.

The do-noting option is therefore not considered a viable option for the reasons outlined above.

Whilst it is noted that the complete removal of weir would facilitate movement of fish listed as qualifying species for the Blackwater River SAC, such movement of fish can be facilitated by the engineered solutions listed above.

4.2.2. Option 2 – Stabilise Remaining Section of Existing Weir

Stabilising the remaining section of the existing weir would involve maintaining the existing breaches that have occurred in the weir. This is unlikely to be acceptable to the various groups that have been formed for the purpose of preserving the existing weir at Fermoy as the aesthetic appearance of the existing structure is in poor condition. It is also likely that CCC could face stakeholder opposition and allegations of neglecting their legal obligations under Part IV of the Planning and Development Act to protect the weir if this option was pursued.

The costs associated with these works would be lower compared to other options given the existing breaches would not be repaired. There would also be no requirement for land acquisition. However, all of the works would need to be carried out in-stream which would be subject to seasonal restrictions.

Fish passage would be provided by the existing breaches in the weir. However, it is possible that this would not be considered satisfactory by IFI for the passage of all fish species at all times during the year and for twaite shad in particular. Therefore, it is unlikely to fully meet the requirements of IFI.

The excessive velocity upstream and through the breach in the Mill Race weir has led to significant bed erosion which may have implications for the integrity of the flood defence infrastructure. These excessive velocities at the Mill Race would also pose the potential risk of gravel silt islands building up downstream of the weir.

Stabilising the existing weir will not provide for satisfactory remediation of the weir and as such will not achieve one of the main project objectives of weir remediation. Given the

remaining section of the weir is not viewed as being visually attractive, this option would most likely experience opposition from stakeholders in this regard as discussed above. The breaches in the existing weir have also led to a reduction of the upstream water level as a considerable amount of the flow passes through the breaches instead of over the weir. Maintaining these reduced upstream water levels would not be favourable to the Fermoy rowing club as this affects their recreational use of the river.

Therefore, this option is not a viable option as it would not satisfy the main project objectives in addition to other issues that would be presented by other stakeholders as outlined above.

4.2.3. Option 3 – Remediate Existing Fish Pass

It is considered that this option would not have any major impacts on the protected weir nor on the recreational activities, such as rowing, which are frequently observed in the river. This in turn would mean that the option would satisfy CCC's Architectural Conservation Officer and would be acceptable to the Fermoy rowing club. The visual impacts of this proposal would also be minimal as the existing fish pass would essentially be restored without any major alterations which would be welcomed by the locals of Fermoy.

Although this option would not require any additional land to be acquired by CCC, significant in-stream works, which would be subject to seasonal restrictions, would be required which in turn would lead to increased construction costs. Future maintenance of this option would also be costly as any maintenance works would involve in-stream works.

Remediating the existing fish pass would not provide for satisfactory fish passage or fish attraction which is due to the orientation and location of the current fish pass as discussed in Section 4.1.2.3. The existing fish pass is contrary to modern fish design principles and is not considered fit for purpose to provide for the passage of all fish species at all times of the year. Therefore, this would not be an acceptable solution to IFI. In addition, the effect of not providing satisfactory passage of migratory fish species listed as qualifying interests for the Blackwater River SAC would be twofold in this instance due to the conservation objectives of the river Blackwater SAC. The conservation objectives provide for the movement of migratory fish species, including twaite shad, which are considered to have limited abilities to move upstream at high current speeds. Remediation of the weir, and the existing breaches, would essentially provide a barrier for twaite shad, salmon, river lamprey and sea lamprey migrating upstream and movement of brook lamprey due to the reinstatement of the weir breaches and the provision of an inadequate fish pass. This would not be compatible with legal obligations to prevent adverse effects on the integrity of the Blackwater River SAC.

Overall, in terms of project objectives this option would not impact on the weir remediation objectives but would not provide for fish passage in all circumstances. As a result, IFI do not consider this option to be viable for fish passage.

In view of the foregoing, this option is not considered viable as it will not provide for satisfactory fish passage for migratory fish species listed as qualifying interests for the

Blackwater River SAC (twaite shad, salmon, river lamprey and sea lamprey and movement of brook lamprey) and could adversely affect the integrity of the Blackwater River SAC.

4.2.4. Option 4 – Complete Removal of Existing Weir

Removal of the remaining sections of the weir would provide for the free passage of fish under all circumstances. However, this would result in reduced river levels which in turn could have an effect on alluvial woodland which is listed as a qualifying interest for the Blackwater River SAC. The lowering of water levels in the reach of the river could reach as much as 1.0m to 1.5m at the location of the weir. The reduced water levels would also impact on the river leisure and amenity uses such as rowing which would be opposed by Fermoy rowing club.

The release of silt which has accumulated upstream of the weir could have effects on other aquatic qualifying species including white clawed crayfish, brook lamprey, otter (via impacts on prey availability), freshwater pearl mussel and the habitat floating river vegetation.

Complete removal of the existing weir would involve CCC breaching their legal obligations under Part IV of the Planning and development Act to protect the weir which would not be acceptable. This option would therefore achieve one of the main objectives of providing for fish passage but would be contrary to the other main objective of weir remediation. As such, complete removal of the weir cannot be considered to be a viable solution.

4.2.5. Option 5 – Construct an In-River Rock Ramp

The construction of an in-river rock ramp would provide for satisfactory passage of all fish species but would require the removal of a significant section of the protected weir given its proposed location upstream of Fermoy bridge. The proposal to incorporate the rock ramp in the weir would be such that no additional land would need to be acquired by CCC. The satisfactory passage of all fish would also mean that this conservation objective of the SAC could be achieved.

The location of the proposed rock ramp would require in-stream works during construction which would be subject to seasonal restrictions and would also result in increased construction costs. This would also be the case for any future maintenance works. The generation of silt and chemical contamination during construction could also have adverse effects on other aquatic qualifying species including white clawed crayfish, brook lamprey, otter (via impacts on prey availability), freshwater pearl mussel and the habitat floating river vegetation. Noise and disturbance could potentially have an adverse effect on otter.

There would be significant visual impacts associated with the ramp due to its proposed location. The rock ramp would also present an obstruction to rowing and other recreational leisure and amenity uses currently undertaken in the river. Furthermore, the discharge that would be directed through the rock ramp in normal flow conditions could pose the risk of scouring to the adjacent bridge piers at the northern end of Fermoy Bridge.

IFI advised that this option would be acceptable to them from a fish passage perspective. However, given the extent of the protected weir that would need to be removed with this option, the other primary objective of weir remediation would not be achieved which would not be compatible with the regulatory obligations arising from the protected structure status of the weir. Therefore, this option would not achieve the primary project objectives and would also face significant opposition from a range of other stakeholders for the reasons outlined above.

While potentially viable in term of legal requirements from the perspective of the Habitats Directive, subject to the outcome of an Appropriate Assessment, this option is not considered to be a viable option in the context of legal obligations arising under Part IV of the Planning and Development Act, 2000.

4.2.6. Option 6 – Construct Fish Ramp (Rock Ramp) in Existing Breach

Constructing a new fish pass in the existing breach would be one of the most expensive options from a construction perspective as all of the works would involve in-stream working which would be subject to seasonal restrictions. Any future maintenance works would also have to be carried out in stream. The extent of in-stream works required could also negatively impact on the conservation objectives of the Blackwater SAC. However, the extent of any potential impacts would need to be identified through an appropriate NIS. From a positive perspective, there would no requirement for CCC to acquire any additional land for this option.

It also unlikely that this option would be deemed acceptable from a conservation perspective of the weir due to aesthetics alone given the new rock ramp would be incorporated into the existing breach in the weir. Based on the scale of the rock ramps in options 5 and 9, the structure would need to extend a significant distance upstream or downstream (or both) of the weir which in turn would make it difficult to integrate within the existing weir both from an aesthetic and functional perspective. Furthermore, the visual impacts on the existing weir (and in general) would be significant as the newer, and considerably larger, fish pass would be located in the river where it would be more prominent.

Satisfactory fish passage may be feasible in most conditions for this option. However, the velocity in the fish pass would be a function of the minimum width of the fish pass and, at approx. 15m wide, this would be narrower than the fish passes considered in options, 5 and 9 which may not be acceptable to IFI. In addition, the breach in the weir is located alongside the south bank at the furthest downstream point meaning the new fish ramp would not be ideally located for fish passage. Therefore, migratory fish listed as qualifying interests for the Blackwater River SAC arriving at the weir may miss the entrance to the fish ramp.

The generation of silt and chemical contamination during construction could also have effects on other aquatic qualifying species including white clawed crayfish, brook lamprey, otter (via impacts on prey availability), freshwater pearl mussel and the habitat floating river vegetation. Noise and disturbance could potentially have an adverse effect on otter.

While this option could potentially achieve one of the main project objectives of fish passage in all circumstances, it would not achieve the other main objective of weir remediation due to the extent of the remediated weir that would be lost to the new fish pass. Therefore, this option is not considered a viable option.

4.2.7. Option 7 – Construct a Near Natural Bypass Channel

The option of a proposed near natural bypass channel located on the northern bank of the river would enable a significant amount of the works to be carried out from land which would reduce the extent of in-stream works required and the associated construction costs. Future maintenance would have the benefit of being able to carry out the majority of the works from land due to the location of the bypass on the northern bank.

The impacts on the Blackwater SAC would also be reduced. The main disadvantage of this option is the relatively large surface area required for its construction. However, due to its narrower channel width, it would actually require less area than a rough channel pool pass bypass of the type considered in Option 9 below. Available land is not a major issue in Fermoy where an adequate area of land is available alongside the weir on the north bank of the river. However, this land where the bypass channel is proposed would need to be acquired by CCC.

IFI subsequently reviewed this option and noted that the resting pools are too small to provide the energy dissipation required to allow for fish passage. In addition to this, IFI considered that the flows would be too low to be attractive to allow downstream fish to locate the fish pass without being delayed.

IFI advised that this option would not provide for satisfactory fish passage and would not be acceptable to them. Given satisfactory fish passage would not be provided by this option, there could be adverse effects on the migratory fish species listed as qualifying interests for the Blackwater River SAC. Therefore, this option would not be compatible with legal obligations to prevent adverse effects on the integrity of the Blackwater River SAC in regard to the conservation objectives for these species. This option would lower the risk of siltation and chemical contamination during construction.

The generation of silt and chemical contamination during construction could have limited effects on other aquatic qualifying species including white clawed crayfish, brook lamprey, otter (via impacts on prey availability), freshwater pearl mussel and the habitat floating river vegetation. Noise and disturbance could potentially have an adverse effect on otter. However, with this option the risk is lower than for alternative instream options.

It is considered that this option would not result in any negative visual impacts as the bypass channel could be incorporated into the surrounding landscape. The near natural bypass channel would not impact on any rowing or other recreational activities in the river and would also enable the primary objective of weir remediation to be achieved. However, given that the other primary objective of fish passage would not be achieved by this option, the near natural bypass channel cannot be considered viable. The use of a natural channel could also lead to increased poaching and/or increased predation risk for migratory fish species.

4.2.8. Option 8 – Bypass River Around Weir

The option of constructing a bypass river around the weir would have the potential to provide for satisfactory fish passage provided the velocities in the bypass channel can be maintained to below 2m/s. This would be subject to detailed design but it should be noted that the catchment area of the Blackwater at Fermoy is in excess of 1750km^2 and there is also a wide variation in flows which would add to the difficulty of maintaining the desired velocity. Therefore, this option may not facilitate free movement of migratory fish species listed as qualifying interests for the Blackwater River SAC (Sea Lamprey, River Lamprey, Twaite Shad and Atlantic Salmon and movement of Brook Lamprey).

Similar to Option 7, the proposed location of the bypass channel would enable a significant amount of the works to be constructed on land thereby reducing the extent of in-stream works and the associated construction costs. Similarly, with any future maintenance, the majority of these works could be carried out on land. The impacts on the Blackwater SAC would also be reduced. Again however, land on the northern bank of the river would need to be acquired by CCC for these works. The visual impacts associated with this option would also be lower compared to other options.

This option would result in a reduction of the water level in the river. If all flow bypassed the weir without any control, it would result in a reduction in water level by approx. 1.0 – 1.5m which could be experienced several kilometres upstream of the existing weir. This scenario would not be favoured by the Fermoy rowing club and the reduced water levels would also impact on the ecology within the Blackwater SAC. This in turn would have a negative effect on the conservation objectives of the SAC and would not be considered acceptable by the NPWS.

Although this option would provide for weir remediation and could potentially provide for satisfactory fish passage, the reduction in the river level that would occur would be likely to adversely affect Alluvial Woodland (which is a qualifying interest of the Blackwater SAC) and also on the Fermoy rowing club's activities. It is not possible to comment on the extent of the impacts on the SAC without an AA being carried out. However, it is most certain that the NPWS would present strong opposition to this option due to the requirements under EU legislation, to preserve the qualifying interests of the designated SAC which would be negatively impacted on as a result of the proposed bypass channel. This in turn could result in court proceedings and subsequent fines for the state by the EU.

The generation of silt and chemical contamination during construction could have effects on other aquatic qualifying species including white clawed crayfish, otter (via impacts on prey availability), freshwater pearl mussel and the habitat floating river vegetation. Noise and disturbance could potentially have an adverse effect on otter. However, with this option the risk is lower than for instream options.

It can therefore be said that this option would satisfy the main project objectives of providing fish passage, under all circumstances, and weir remediation which would be acceptable by IFI and the CCC Architectural Conservation Officer respectively. However, this option would have the potential to have adverse effects on the integrity of the Blackwater SAC through lowering of the river levels upstream of the weir with potential adverse effects on alluvial woodlands. This option would lower the risk of siltation and chemical contamination during construction.

Therefore, this is a viable option. However, it will have a permanent impact, reducing water levels upstream of the weir. This will negatively impact established leisure and amenity activities such as rowing and wheelchair boating.

4.2.9. Option 9 – Construct a Rough Channel Pool Bypass

Construction of a rough channel pool bypass to provide for fish passage would enable a significant amount of construction to be carried out on land which would significantly reduce the amount of in-stream works required. This in turn would reduce construction costs and would also reduce the construction impacts on the Blackwater SAC. Future maintenance works could also be predominantly carried out from land which in turn is more favourable compared to other options which would require in-stream works due to the location of the fish pass.

The principal disadvantages with this option are:

- Sensitivity to fluctuating headwater levels.
- The large discharges necessary for its operation.
- The large amount of space occupied.

This option also has the following advantages:

- It can provide passage for small fish and fry and by the benthic invertebrates.
- It is also suitable for downstream migration of fish.
- It can be designed to be natural-looking and visually attractive
- It requires little maintenance in comparison with other constructions.
- It is not easily clogged; deposits of flotsam and flood debris do not immediately affect the efficiency of the installation.
- The guide currents are satisfactory and easily located by fish.
- It can provide a habitat for species of fish which prefer flowing water (rheophilic).

The bypass is proposed on the northern bank of the river and would therefore require the land to be acquired by CCC. The location of the bypass channel would be such that the existing weir would not be impacted and the proposed remediation works could be achieved. However, although construction costs would be reduced due to the reduction of in-stream works, it is considered that the overall cost of this option would be at the higher end of the scale due to the extent of the structure required.

The existing water levels in the river could be maintained for rowing and other recreational activities by setting the remediated weir and proposed bypass at appropriate heights to ensure the existing levels are not altered. This would be favourable from the Fermoy rowing club's perspective.

Satisfactory fish passage would be provided by this option which in turn would be in keeping with the conservation objectives for the Blackwater SAC in terms of maintaining the movement of migratory fish species listed as qualifying interests for the Blackwater SAC. Adverse effects on Alluvial Woodland upstream of the weir could also be prevented as the river levels would not be reduced any lower than the current level which was proposed in option 8. This option would lower the risk of siltation and chemical contamination during construction.

The generation of silt and chemical contamination during construction could have effects on other aquatic qualifying species including white clawed crayfish, brook lamprey, otter (via impacts on prey availability), freshwater pearl mussel and the habitat floating river vegetation. Noise and disturbance could potentially have an adverse effect on otter. However, with this option the risk is lower than for instream options.

From a visual perspective, it is possible that this option would be open to criticism due to the scale of the structure required which could be considered to be heavily engineered. However, there is scope for incorporating the fish pass into the surrounding landscape which could be achieved by replacing vertical side walls for graded slopes where possible and by combining the use of trees, vegetation, shrubs, etc. to help incorporate the structure into the receiving environment.

IFI were previously consulted on this option back in 2014 and advised that this option would provide for passage of all fish species, at all times of the year which is IFI's primary concern. From a heritage perspective, this proposal would have minimal (if any) impact on the existing weir, would not impact on the proposed weir remediation works and would be acceptable to CCC's Architectural Conservation Officer. Therefore, this can be considered to be a viable option.

4.2.10. Summary

The above sections further describe the fish pass options that have been considered and illustrates the difficulty in identifying a solution that can satisfy both the main project objectives as well as a range of other factors and stakeholders.

Viable options are ones that can meet the legal requirements of the Habitats Directive while also allowing the remediation of the protected structure. Those options which achieve this while also facilitating leisure and amenity users of the river are considered the most viable options.

Some options do not satisfy the legal requirements of the Habitats Directive and are not considered viable for that reason. Options in this category include Options 1 to 3.

Other options do not respect the protected structure status of the weir and would result in Cork County Council failing to fulfil its obligations to prevent further deterioration of the weir. Options 4, 5 and 6 could be considered to fall into this category.

Options 7, 8 and 9 provide for the full reinstatement of the weir. Although in the case of Option 8, the weir would normally have no flow over it and would therefore impact on leisure and amenity uses upstream of the weir. Option 7 is not likely to satisfy the requirement for passage for all fish and does not meet Fisheries Ireland's requirements for fish pass design. Of all of the options, Option 9 is likely to best satisfy the legal requirements of the Habitats Directive while allowing for the remediation of the weir structure in its entirety and the continuation of established amenity and leisure uses upstream of the weir.

The construction of Option 9 would satisfy the requirements of IFI in terms of providing for the passage of all Annex II species listed in the Habitats Directive. The fish pass also must

be designed to be passable by Eel. This is not an Annexed species or a qualifying interest for the Blackwater River SAC, but is a critically endangered red listed species.

4.3. Land Acquisition

4.3.1. Fish Bypass Channel

A potential fish bypass channel in the northern bank of the Blackwater river (as envisaged in Options 7, 8 and 9) would require a section of land to be acquired by Cork County Council in order to facilitate its construction. A portion of land forming part of Folio No. CK24179L (Plan No. DCMW3) would need to be acquired as illustrated by Figure 4-3 below.

The section of land adjoining Fermoy bridge, known locally as the Triangle or Circus field would also be impacted by the proposed bypass channel. However, this section of land is not registered according to the Land Direct website but is understood to be in the ownership of Cork County Council.

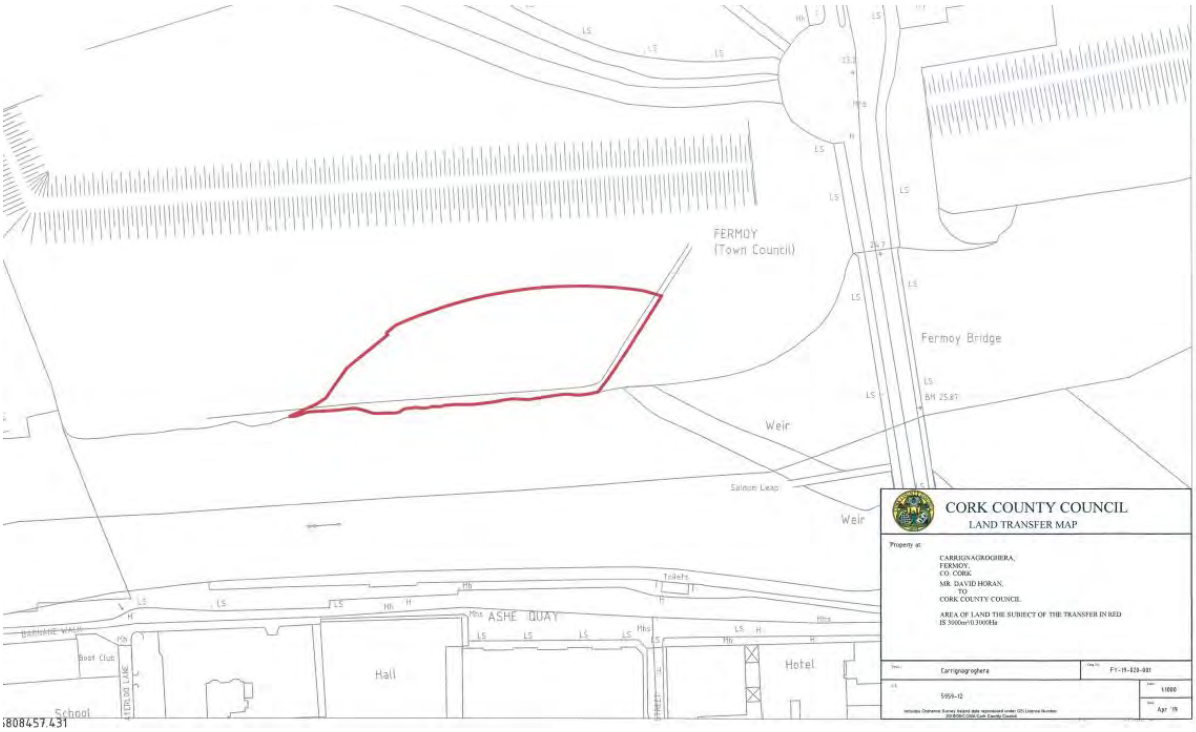


Figure 4-3: Land and Easements to be Acquired for Proposed Works

4.3.2. Mill Race Works

Access will also be required for any works proposed at the Mill Race island. A section of land forming part of Folio No. CK93050F (Plan No. A15D6), which is located south east of Fermoy bridge, is in the ownership of Cork County Council and would provide the access route for any proposed works at Mill Island and on the south side of the river.

As discussed in Section 1.4.4, the Mill Race section has experienced significant erosion in recent times as evident in Figures 1-14 and 1-15 with the wall at further risk of collapse having being undermined. As a result of this, the OPW have indicated that they would carry out emergency works in this area if the erosion issues continue to the extent that the anchors to the flood defence wall referenced Wall 21 to the east of the weir are considered to be at risk of being undermined.

The scope of works required to reinstate the Mill Island riverbank wall will depend on the nature and extent of emergency works undertaken by the OPW.

5. NEXT STEPS

5.1. Development of Planning Documentation

Following the completion of the stakeholder and public consultation and the identification of a preferred solution for the project, the next major project task on the current programme will be the development of planning documentation for the proposed scheme. It is expected that the planning documents and drawings will be prepared and ready for the submission of the Part X planning application and accompanying Natura Impact statement to An Bord Pleanála in Q1 of 2021.

An Bord Pleanála has published Guidelines for Local Authorities in respect of "*Applications for approval for Local Authority Developments made to An Bord Pleanála under 177AE of the Planning and Development Act, 2000, as amended (Appropriate Assessment)*". These guidelines include information on the typical plans, particulars and other considerations required to be addressed in the application.

Of particular relevance is the requirement in these guidelines for construction methodology statements describing the full extent of all aspects of the proposed development, including location of any site compounds, car parking, materials storage areas, lagoons etc. and mitigation measures where proposed. Cork County Council's Architectural Conservation Officer will require a detailed method statement for the repair and reinstatement works at the weir.

The application will have to include a justification for the project; reference to the main Development Plan; provisions relating to the site and surrounding area; national, regional and local policies and a description of adjoining abutting or adjacent land uses.

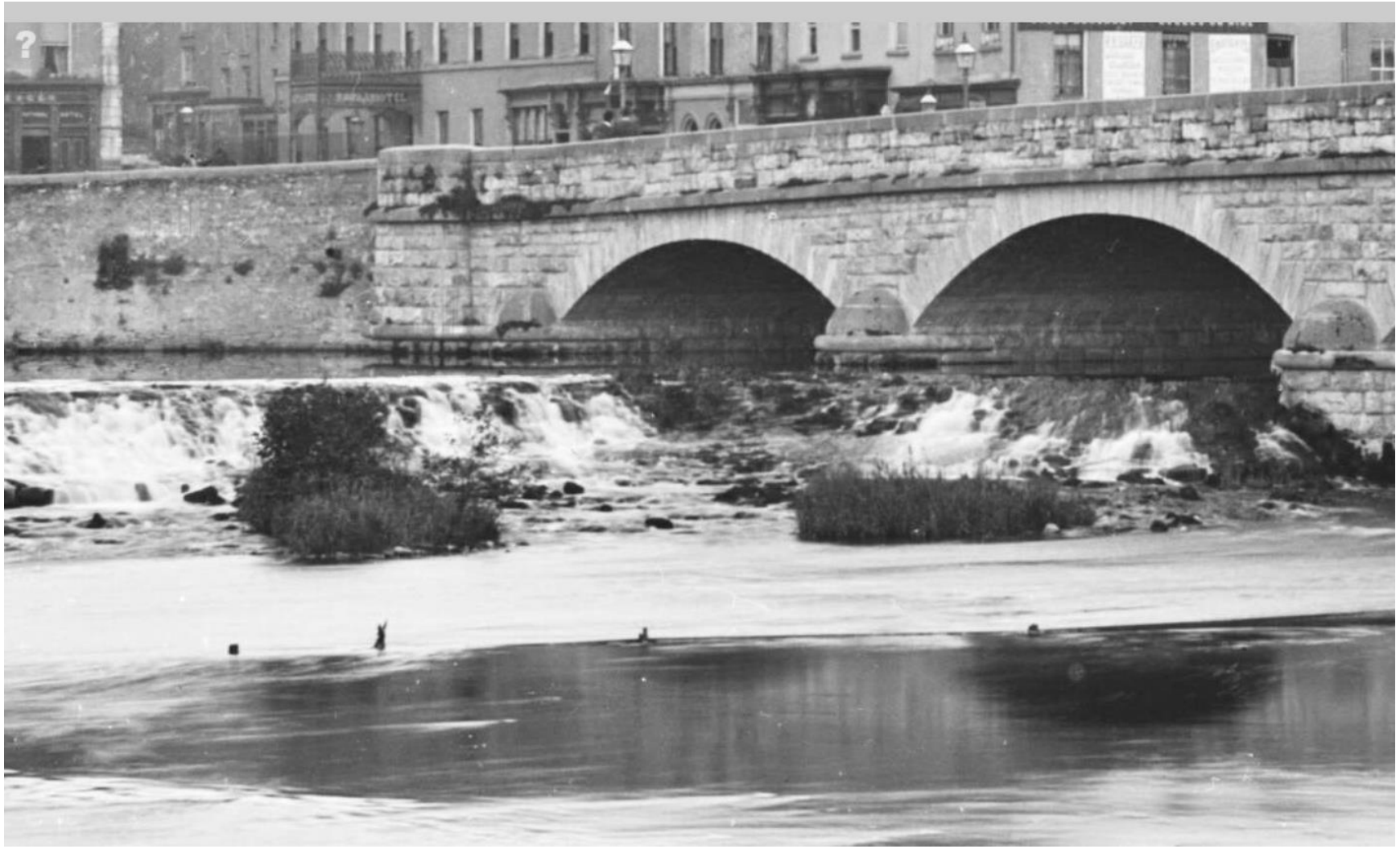
The Natura Impact Statement will be required to describe the likely significant effects of the development on the Munster Blackwater SAC and any other European sites potentially within the zone of influence. The NIS must include any survey work, baseline studies and further analysis and assessment of the effects on the SAC and any other European Sites.

The aforementioned Guidelines also set out the administrative matters to be addressed when a local authority makes an application to the Board, including notifications to prescribed bodies and public notice forms to be followed.

APPENDIX A

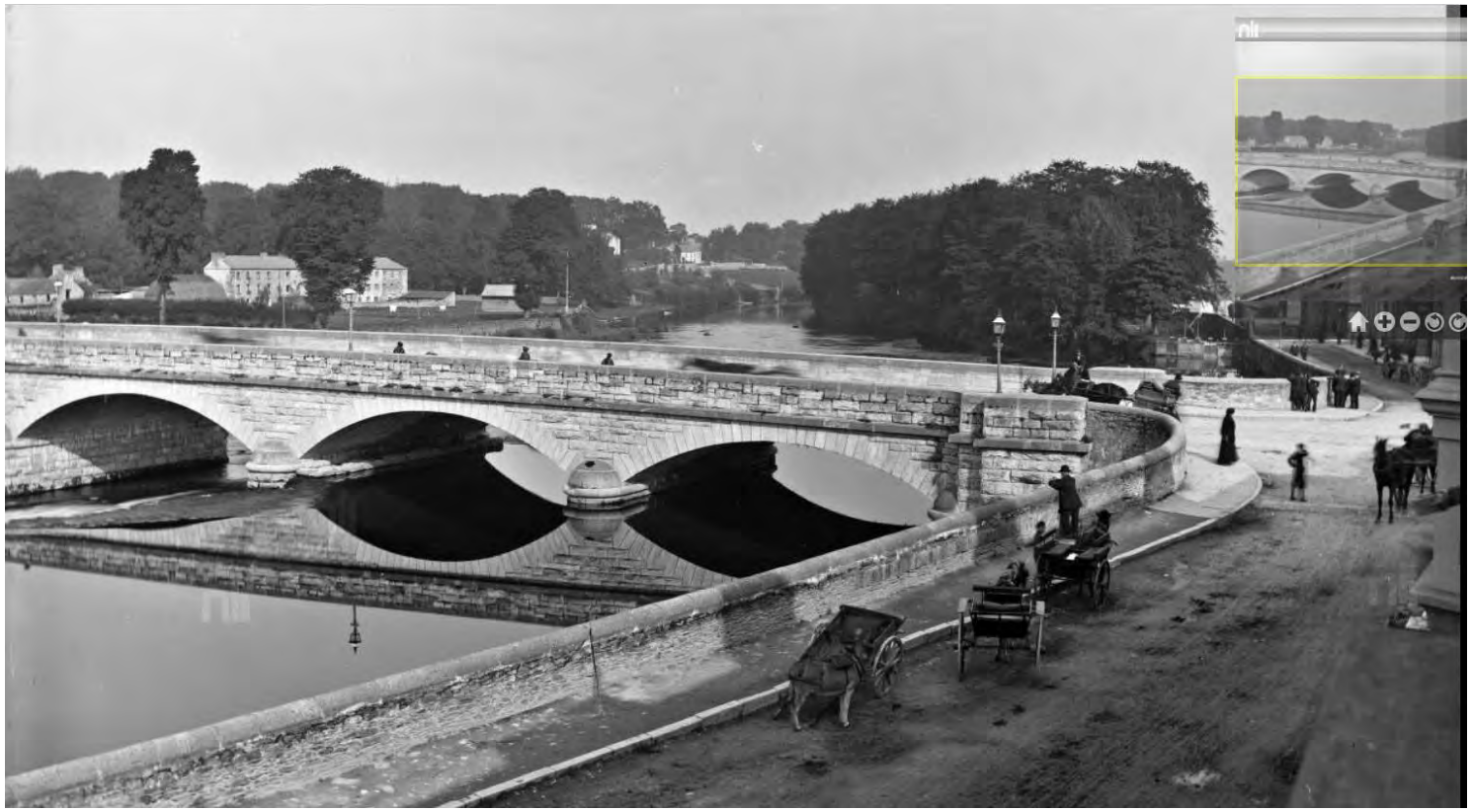
Historical Photos of Weir

General View, Fermoy, Co. Cork [graphic]
by French, Robert, 1841-1917 photographer
Published / Created: [between ca. 1865-1914].
In collection: The Lawrence Photograph Collection
"...Fermoy. Co. Cork. 50. W. L...."

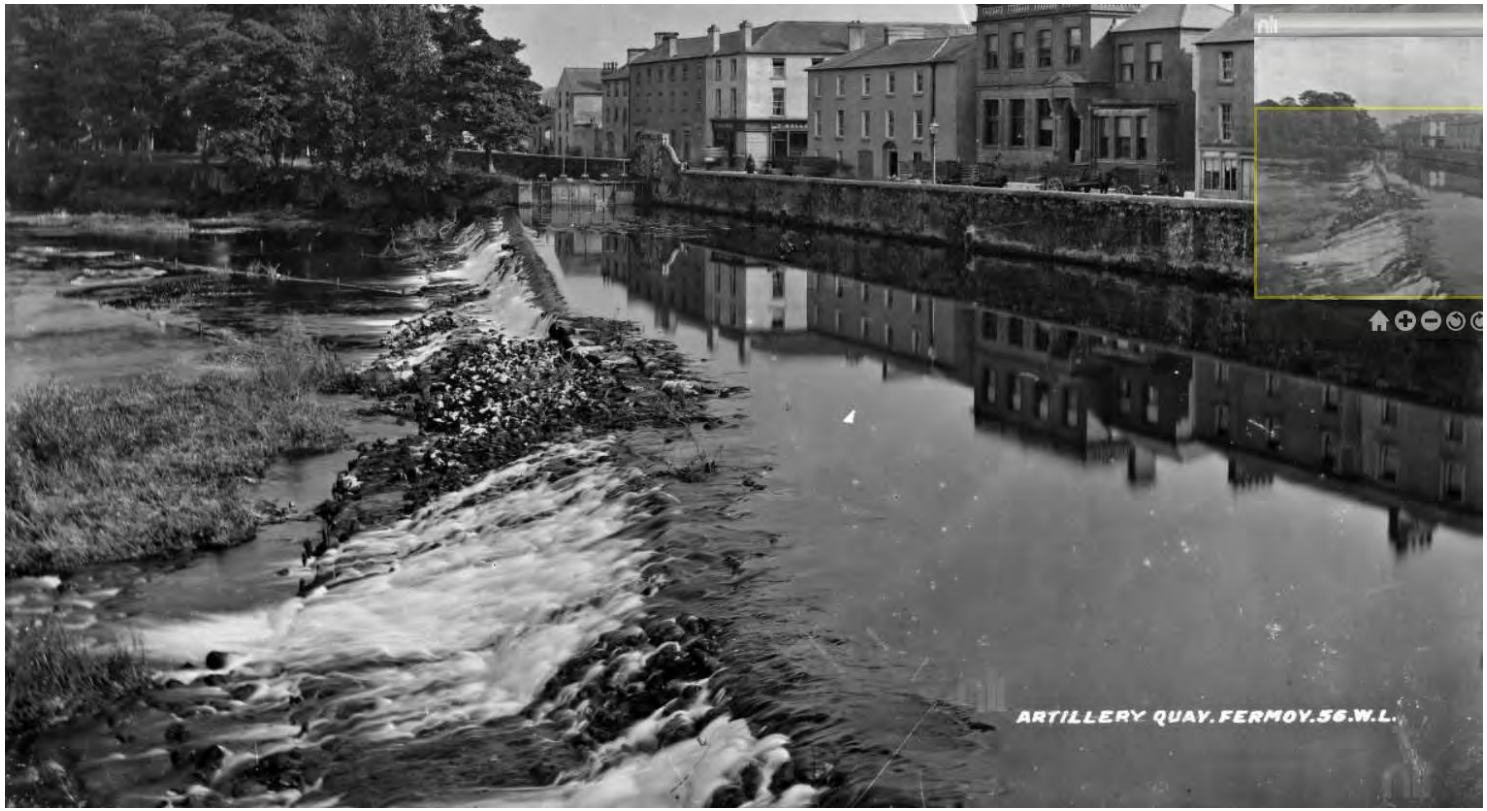


Enlargement of Previous

Blackwater River, Fermoy, Co. Cork [graphic]
by French, Robert, 1841-1917 photographer
Published / Created: [between ca. 1865-1914].
In collection: The Lawrence Photograph Collection
"…River Blackwater. Fermoy. 55. W. L….



Blackwater River (from Ashe Quay), Fermoy, Co. Cork [graphic]
by French, Robert, 1841-1917 photographer
Published / Created: [between ca. 1865-1914].
In collection: The Lawrence Photograph Collection
"…River Blackwater. Fermoy. 7218. W. L…."



Artillery Quay (Now O'Neill Crowley Quay), Fermoy, Co. Cork [graphic]
by French, Robert, 1841-1917 photographer
Published / Created: [between ca. 1865-1914].
In collection: The Lawrence Photograph Collection
"…Artillery Quay. Fermoy. 56. W. L…."

Enlargement of Previous

General View (Mill Race Weir), Fermoy, Co. Cork [graphic]
by French, Robert, 1841-1917 photographer
Published / Created: [between ca. 1865-1914].
In collection: The Lawrence Photograph Collection
"…Fermoy 1418. W. L…."

Salmon Leap, Fermoy, Co. Cork [graphic]
by French, Robert, 1841-1917 photographer
Published / Created: [between ca. 1865-1914].
In collection: The Lawrence Photograph Collection
"…Salmon Leap. Fermoy. 7216. W. L…."

Enlargement of Above showing weir crest close to top of masonry blockwork at Fish Pass

Fermoy Fish Pass – Eblana Collection (ca. 1870-189)

APPENDIX B

2014 Fish Pass Options

FERMOY BRIDGE - PROTECTED STRUCTURE
Reg No. 199 ON FERMOY RECORD OF PROTECTED STRUCTURES 2010-2016

FERMOY WEIR - PROTECTED STRUCTURE
Reg No. 02 ON FERMOY RECORD OF PROTECTED STRUCTURES 2010-2016

LAND ON WHICH IT IS PROPOSED TO CARRY OUT THE PROPOSED WORKS

NEW FISH COUNTER WITH BUILT IN DIGITAL CAMERA IN ACCORDANCE WITH THE SPECIFICATION.

NEW ROCK ARMOURING TO FORM CHANNEL TOWARDS THE FISH PASS AND AWAY FROM OVERFLOW FROM WEIR DOWNSTREAM OF BRIDGE.

55m LENGTH OF CHANNEL TO BE DREDGED

TRASH SCREEN

UNDERWATER POWER SUPPLY AND DATA CABLING TO FISH COUNTER AND BUILT IN DIGITAL CAMERA. UNDERWATER CABLING TO BE PINNED AND WEIGHTED TO THE BED OF THE RIVER IN ACCORDANCE WITH THE SPECIFICATION. CABLES THAT PENETRATE THROUGH FLOOD DEFENCE STRUCTURES ARE TO BE PROVIDED WITH A HAWKE TRANSIT SYSTEM MULTICABLE WATER SEAL WITH RECTANGULAR STEEL FRAME FIXED TO THE FACE OF THE RC WALL OR SHEETPILE. HAWKE TRANSIT SYSTEM OR EQUAL AND APPROVED SHALL PREVENT THE TRANSFER OF WATER TROUGH SERVICE OPENINGS IN THE FLOOD DEFENCE STRUCTURE.

CABLE WATER SEALS TO BE PROVIDED ON THE FACE OF THE FLOOD DEFENCE STRUCTURES BY THE FISH PASS WORKS CONTRACTOR

KIOSK TO HOUSE FISH COUNTER HARDDRIVE, POWER SUPPLY TO COUNTER & CAMERA AND RECORDING DEVICES FOR CAMERA.
KIOSK TO BE HOUSED IN NEW TOILET BLOCK BUILDING, WITH ACCESS PROVIDED TO INLAND FISHERIES IRELAND

NEW TOILET BLOCK TO BE CONSTRUCTED BY OTHERS

LINE OF FLOOD DEFENCE STRUCTURES

4 No. 100Ø DUCTS TO BE PROVIDED BY THE FLOOD DEFENCE WALL CONTRACTOR BETWEEN THE LINES OF THE FLOOD DEFENCE STRUCTURES AR RIVERBED LEVEL DURING THE CONSTRUCTION OF THE FLOOD DEFENCE WALLS. FISH PASS CONTRACTOR TO PROVIDE AND INSTALL CABLING FROM FISH COUNTER TO THE FISH COUNTER EQIPMENT IN THE NEW TOILET BLOCK.

LEGEND:

EXTENT OF EXISTING FISH PASS STRUCTURE TO BE RETAINED AND REPAIRED

EXTENT OF EXISTING FISH PASS STRUCTURE TO BE DEMOLISHED AND REPLACED WITH NEW FISH PASS STRUCTURE

ASHE QUAY

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

NOTES:

1. THIS DRAWING TO BE READ IN CONJUNCTION WITH THE SPECIFICATION

2. ALL WORKS IN THE RIVER AND TO THE FISH PASS ARE TO BE AGREED WITH INLAND FISHERIES IRELAND PRIOR TO COMMENCEMENT OF THE WORKS

3. REFER TO HYDROGRAPHICS SURVEYS LTD. DRG No. HS86/10 FOR EXISTING RIVERBED AND FISH PASS LEVELS

REV	STAT	DESCRIPTION	DATE
P01	S2	ISSUED FOR INFORMATION	09.04.2020

DRAWING STATUS: ISSUED FOR INFORMATION

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

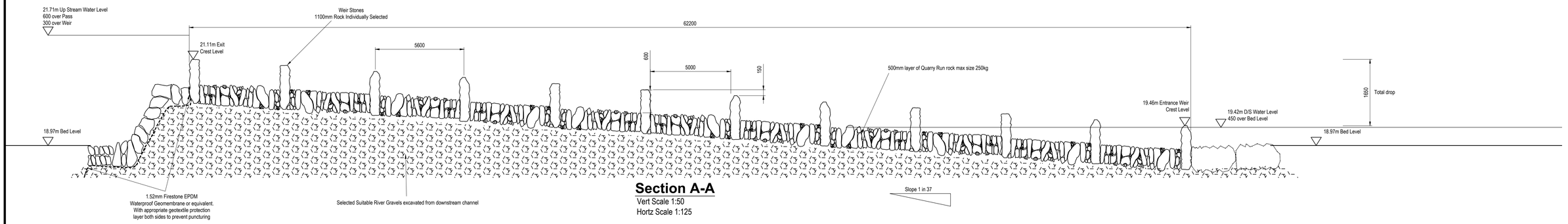
CLIENT: CORK COUNTY COUNCIL

DRAWING TITLE: FISH PASS OPTION 1
UPGRADE OF EXISTING FISH PASS

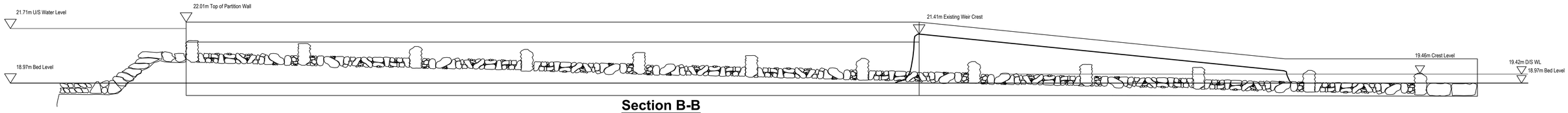
SCALE: 1:250 (A1)

PROJECT - ORIGINATOR - VOLUME - LOCATION - TYPE - ROLE - NUMBER
19011-TJOC-XX-XX-DR-C-0003

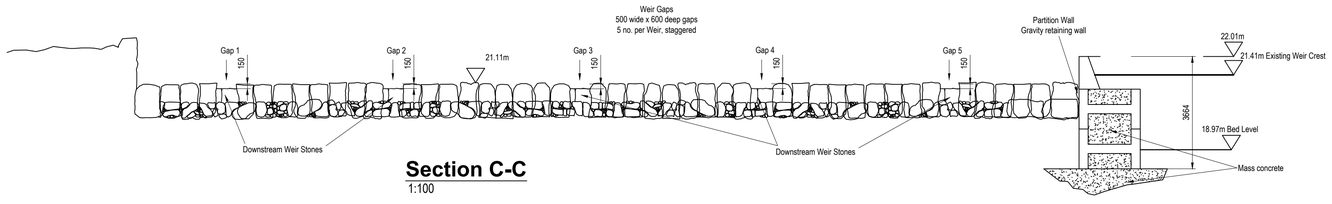
REV: P01



Section A-A
Vert Scale 1:50
Hortz Scale 1:125



Section B-B
1:100



Section C-C
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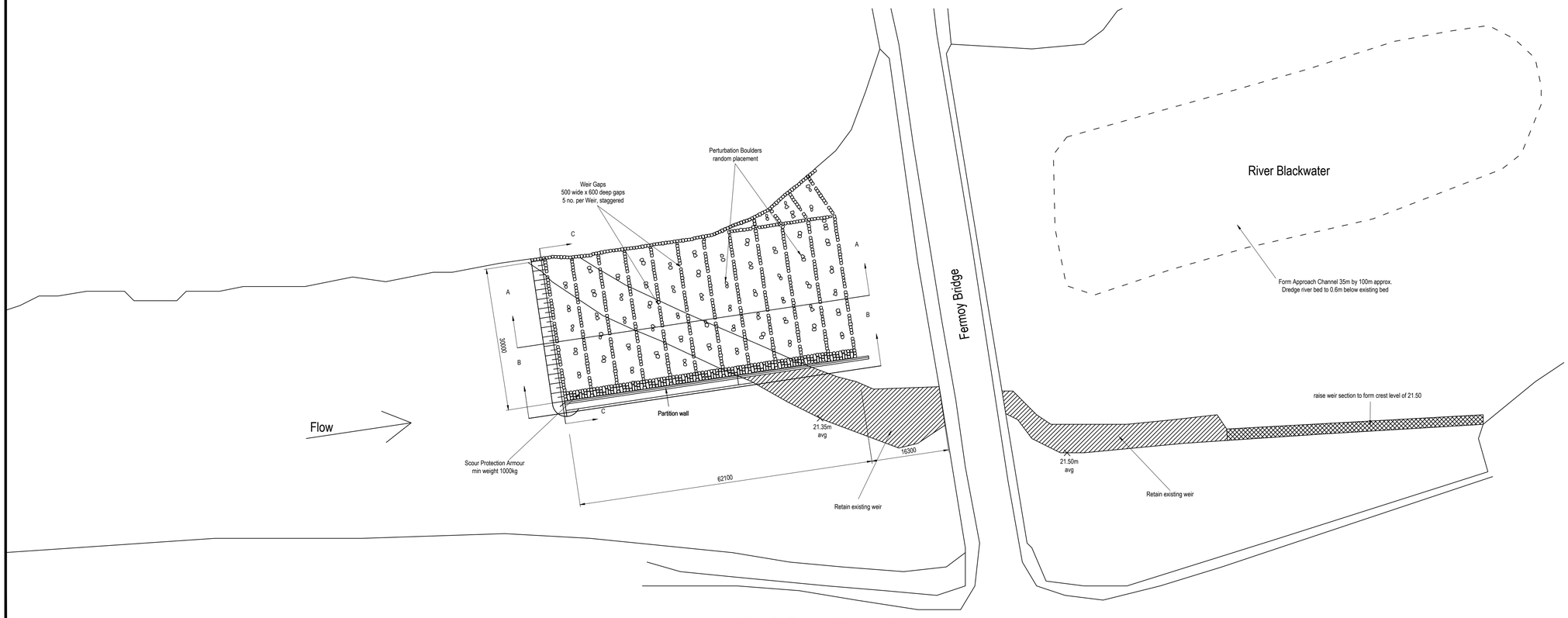

Rock Ramp Layout
1:500

REV	STAT	DESCRIPTION	DATE
P01	S2	ISSUED FOR INFORMATION	09.04.2020

DRAWING STATUS: ISSUED FOR INFORMATION

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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

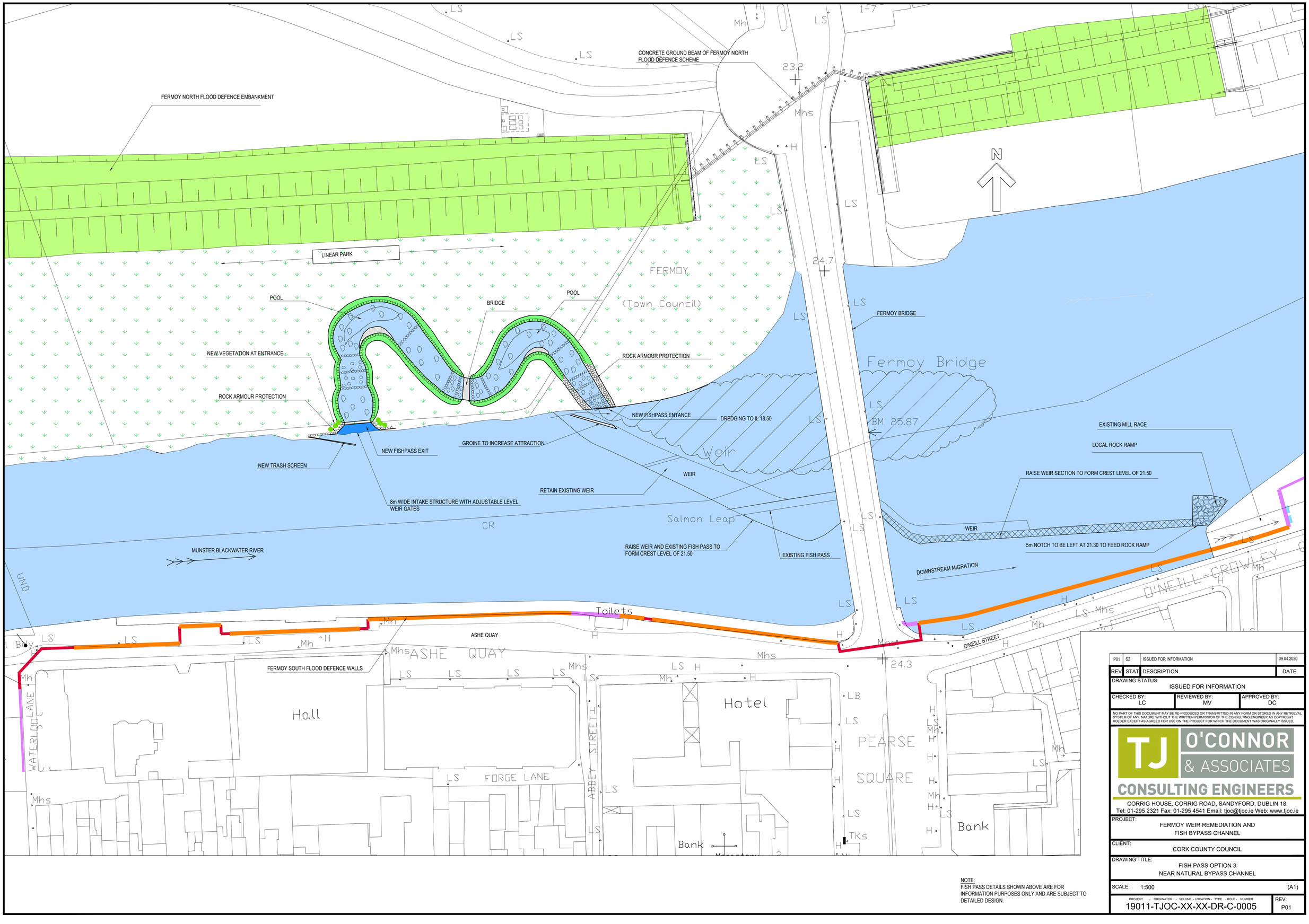
CLIENT:
CORK COUNTY COUNCIL

DRAWING TITLE:
FISH PASS OPTION 2
IN RIVER ROCK RAMP

SCALE: 1:250 (A1)

PROJECT - ORIGINATOR - VOLUME - LOCATION - TYPE - ROLE - NUMBER
19011-TJOC-XX-XX-DR-C-0004

REV: P01



NOTE:
FISH PASS DETAILS SHOWN ABOVE ARE FOR INFORMATION PURPOSES ONLY AND ARE SUBJECT TO DETAILED DESIGN.

REV	STAT	DESCRIPTION	DATE
P01	S2	ISSUED FOR INFORMATION	09.04.2020

DRAWING STATUS: ISSUED FOR INFORMATION

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: FISH PASS OPTION 3 NEAR NATURAL BYPASS CHANNEL

SCALE: 1:500 (A1)

PROJECT - ORIGINATOR - VOLUME - LOCATION - TYPE - ROLE - NUMBER
19011-TJOC-XX-XX-DR-C-0005

REV: P01

FERMOY NORTH FLOOD DEFENCE EMBANKMENT

CONCRETE AND STONE CLADDING

LANDSCAPED 1:4 SLOPE

PERTURBATION BOULDERS, RANDOM PLACEMENT

NEW WEIR LEVEL TO MAINTAIN WATER LEVEL AS EXISTING

BANK ALIGNMENT TO BE FINALISED

LANDSCAPED 1:3 SLOPE

FISH POOLS CREATED BY VARYING LEVEL OF ROCK WEIR WALLS

RAISE WEIR AND EXISTING FISH PASS TO FORM CREST LEVEL OF 21.45mOD IN DRY WEATHER CONDITIONS

EXISTING FISH PASS

RAISE WEIR SECTION TO FORM CREST LEVEL OF 21.55mOD

EXISTING MILL RACE

FERMOY BRIDGE

FERMOY SOUTH FLOOD DEFENCE WALLS

ASHE QUAY

FERMOY (Town Council)

Fermoy Bridge

Weir

Salmon Leap

Toilets

Hall

Hotel

Bank

PEARSE SQUARE

ABBEY STREET

FORGE LANE

WATERLOO LANE

O'NEILL-CROWLEY

O'NEILL STREET

BM 25.87

NOTE:
FISH PASS DETAILS SHOWN ABOVE ARE FOR INFORMATION PURPOSES ONLY AND ARE SUBJECT TO DETAILED DESIGN.

REV	STAT	DESCRIPTION	DATE
P02	S2	ISSUED FOR INFORMATION	22.04.2020
P01	S2	ISSUED FOR INFORMATION	09.04.2020

DRAWING STATUS: ISSUED FOR INFORMATION

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: FISH PASS OPTION 4
ROUGH CHANNEL POOL PASS TYPE BYPASS CHANNEL

SCALE: 1:500 (A1)

PROJECT - ORIGINATOR - VOLUME - LOCATION - TYPE - ROLE - NUMBER
19011-TJOC-XX-XX-DR-C-0006

REV: P02

APPENDIX C

Options considered for the Fermoy Weir Remediation and Fish Bypass Project

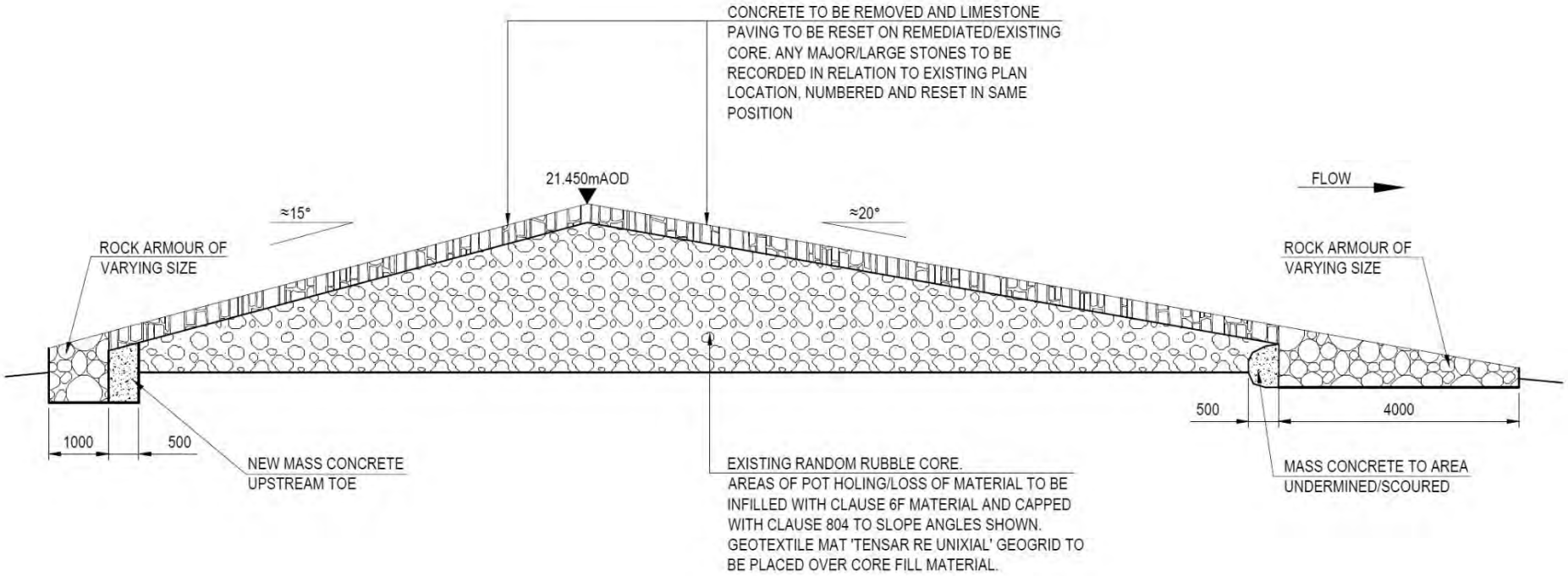
Options Considered
Must satisfy different demands

Weir Repair

- Reconstruct using original materials
- Record and replace as new

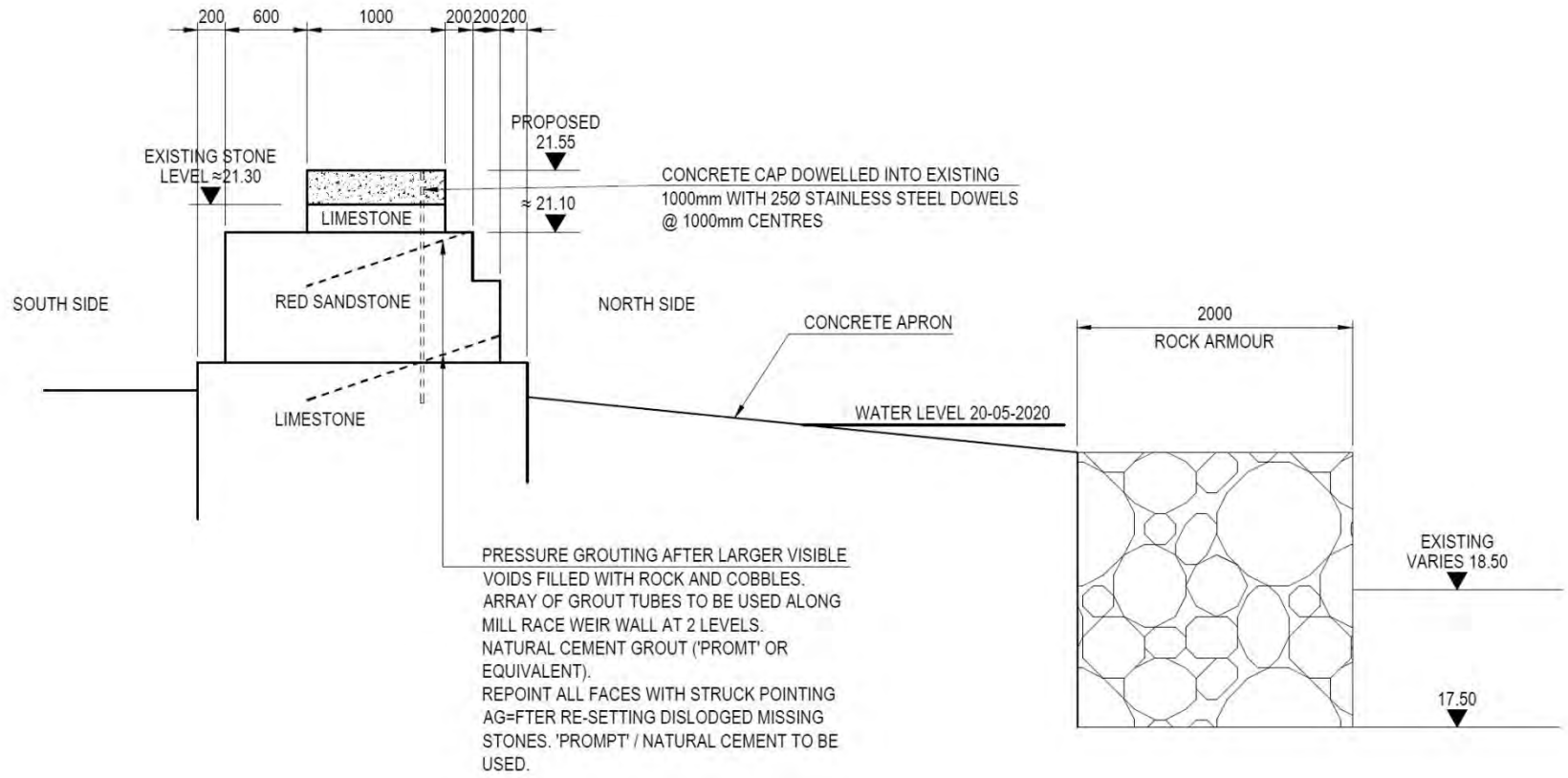
Fish Passage

1. Do Nothing
2. Stabilise remaining section of weir
3. Remediate the existing fish pass.
4. Complete removal of the weir
5. Construct an in-river rock ramp.
6. Construct a fish ramp (rock ramp) in the existing breach
7. Construct a near natural bypass channel.
8. Bypass river around weir
9. Construct a rough channel pool bypass.



Crump Weir Typical Section of Proposed Remediation

- Strip off Concrete apron
- Rock armour and concrete to stabilise toe of embankment
- reinstate limestone cobbles on face of weir



Mill Race Weir Wall Typical Section of Proposed Remediation

- Fill larger voids in wall with rock and cobbles
- Pressure grout using natural cement
- Re set dislodged stones and Point all faces
- Re Build breached section of wall using similar type materials

1. Do Nothing

Leave existing situation as is

Weir will continue to deteriorate

Complete collapse will eventually allow fish migration

Bank and bed erosion could undermine flood defences

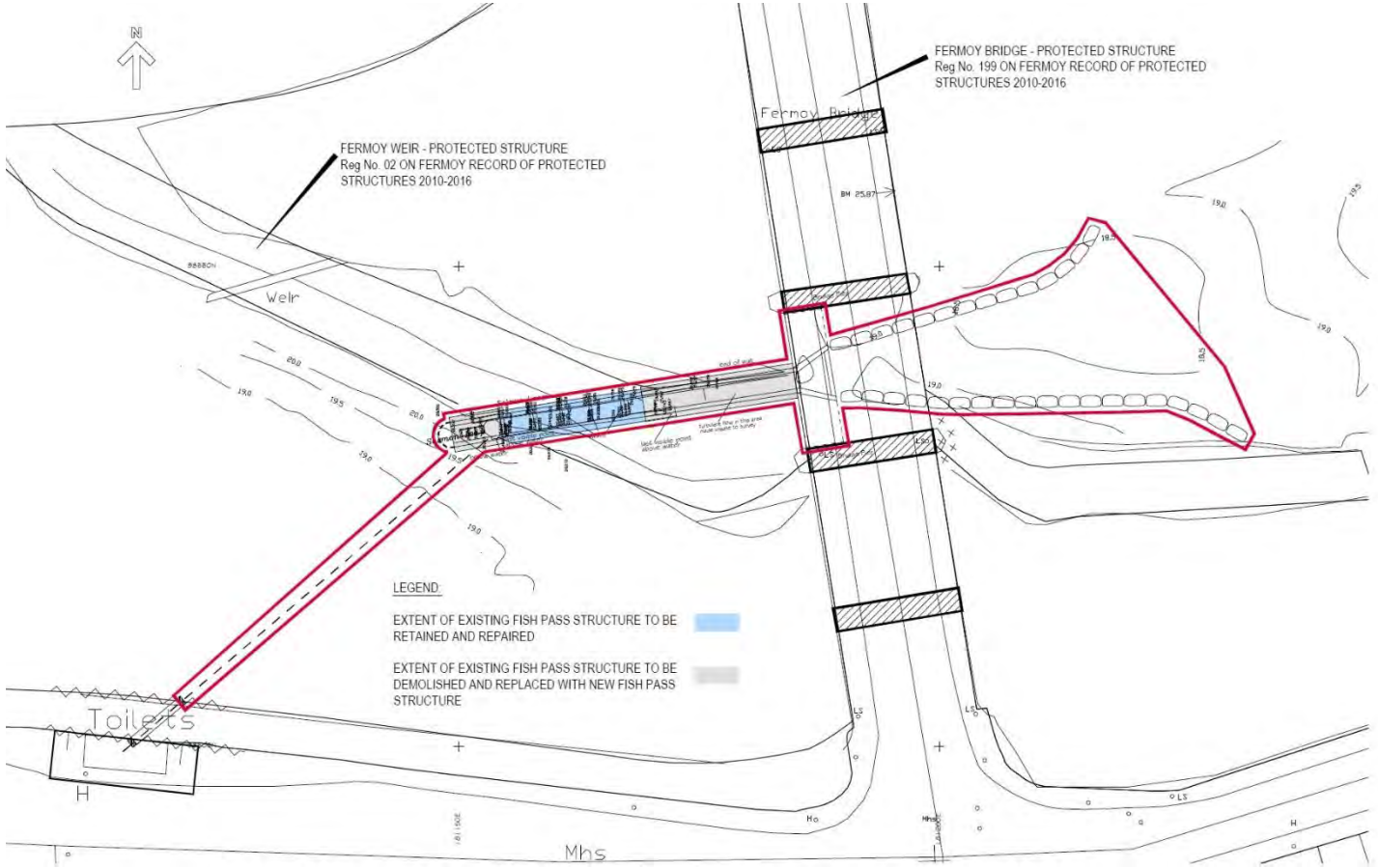
2. Stabilise remaining section of weir

Leave existing breach in place

Upstream river level would not return to pre-breach levels

Excessive velocities in mill race channel causing bed and bank erosion

Passage of all fish species not ensured



3. Remediate Existing Fish Pass

Not ideally located at upstream end of weir

Does not provide satisfactory fish passage

Therefore does not satisfy Conservation objectives

Acceptable for Protected Structure Status

Maintains upstream river levels

4. Complete removal of the weir

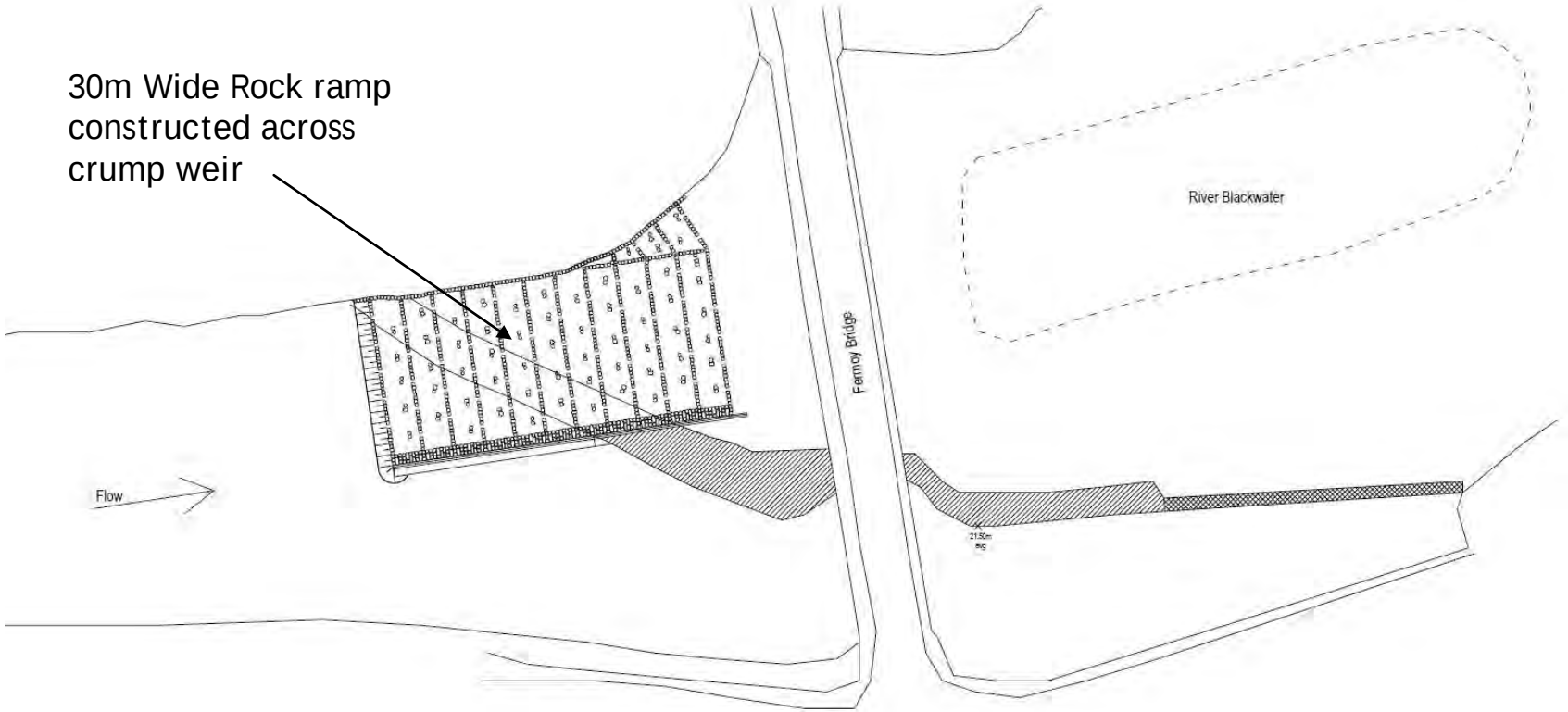
Provides for free passage of fish

Lower river levels U/S of Bridge

Protected structure status breached

River amenities affected, e.g. rowing

Potential issues for Flood defence structures if bed levels are lower



5. Construct an in-river rock ramp.

Provides satisfactory passage for all fish

Requires removal of part of protected structure

Extends upstream in main channel of river affecting amenity uses

Visual impact alongside bridge

Potential scour impact on bridge piers

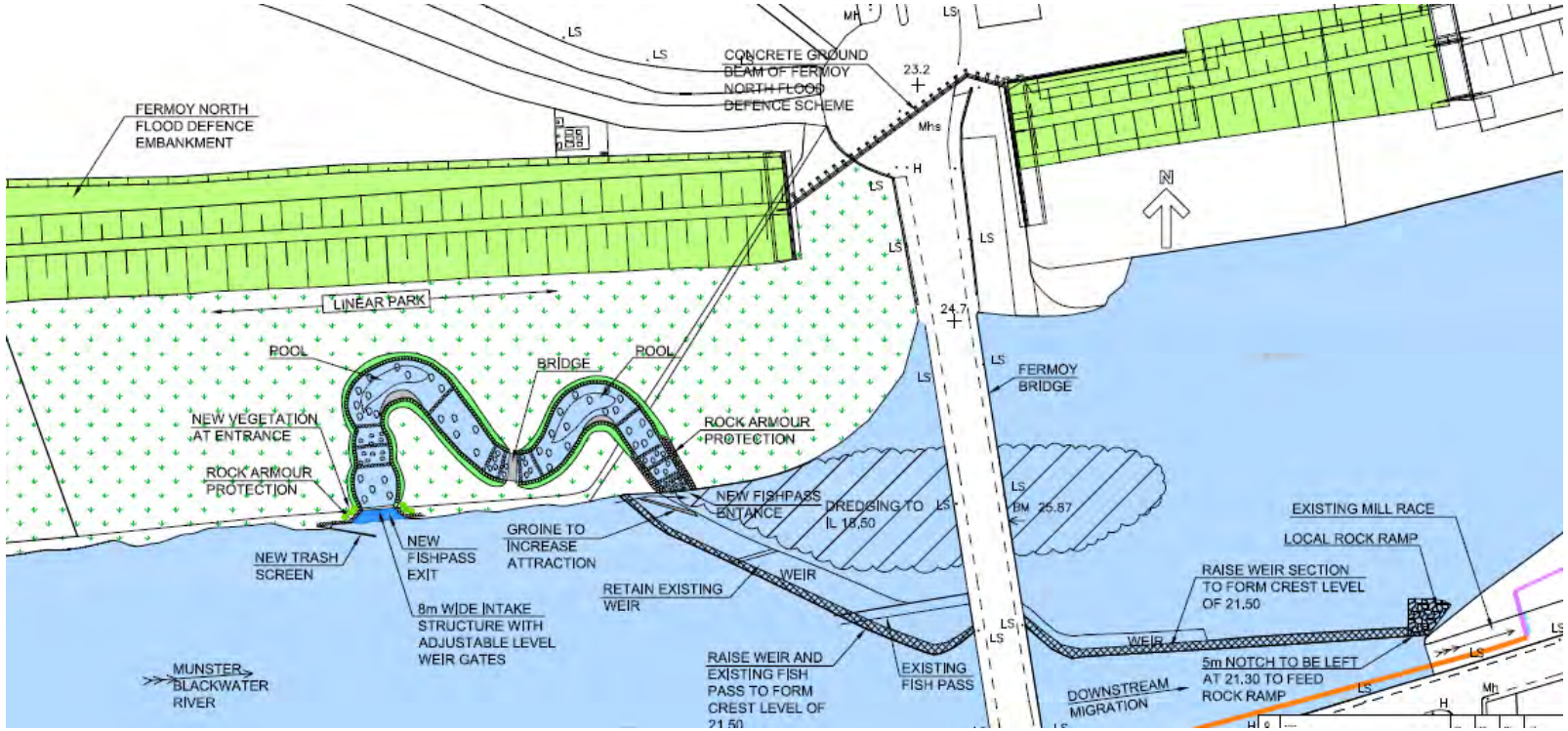
6. Fish Ramp (rock ramp) in the Existing Breach

Ramp not ideally located to attract fish

May be issues with excessive velocities

May conflict with flood defence structural design

Protected Structure obligations not fully complied with



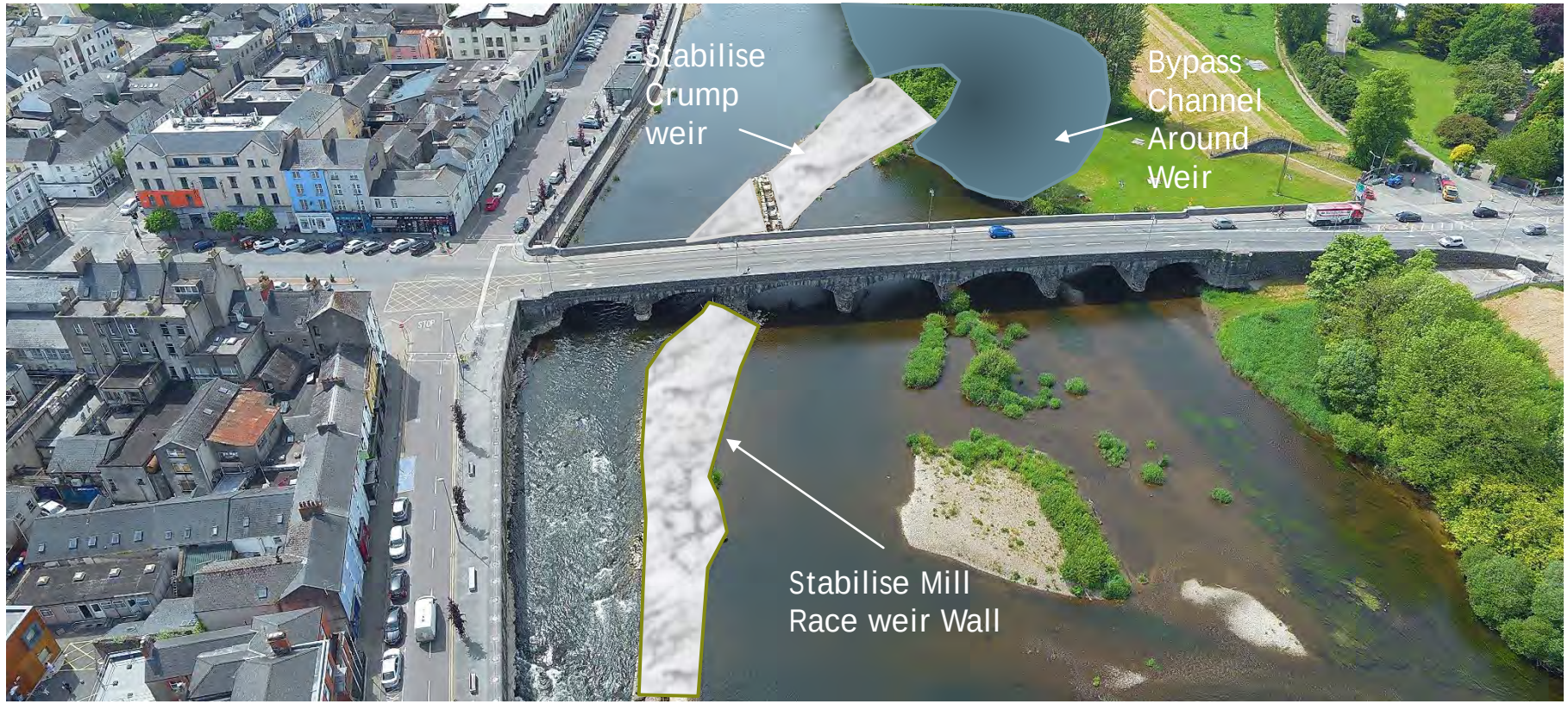
7. Near Natural Bypass Channel

Reduces in-stream works

Land acquisition required

May not facilitate passage of all fish

Avoids negative visual impacts



8. Bypass Channel Around Weir

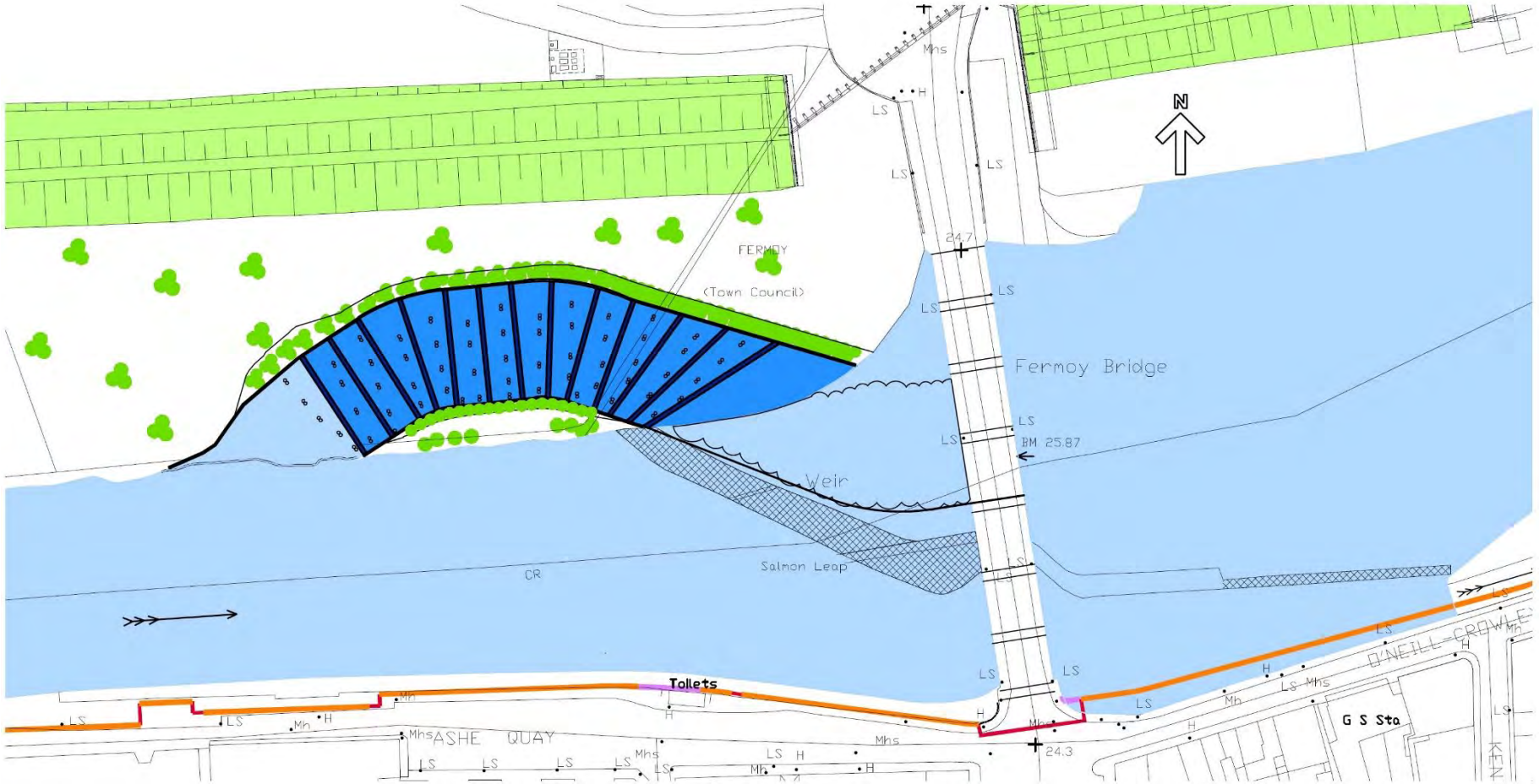
Large flow to be accommodated in Bypass channel

Fish Passage accommodated

Upstream Water Levels lowered

Adverse impacts on Conservation objectives

Large land Acquisition required



9. Rough Channel Pool Bypass

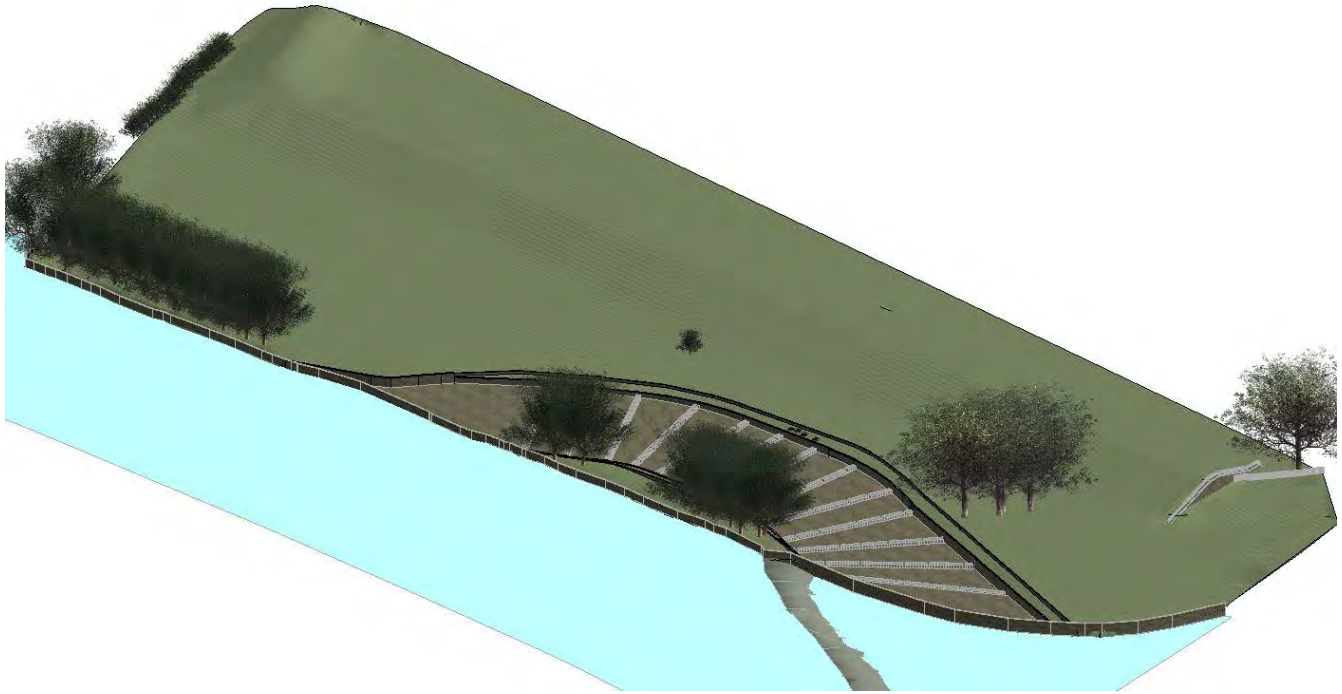
Maintains Upstream Water level

Facilitates fish passage

Minimises instream works

Land acquisition required

Significant visual impact



9 Rough Channel Pool Bypass

3d View

Thank You

TJ O'CONNOR & ASSOCIATES
CONSULTING ENGINEERS