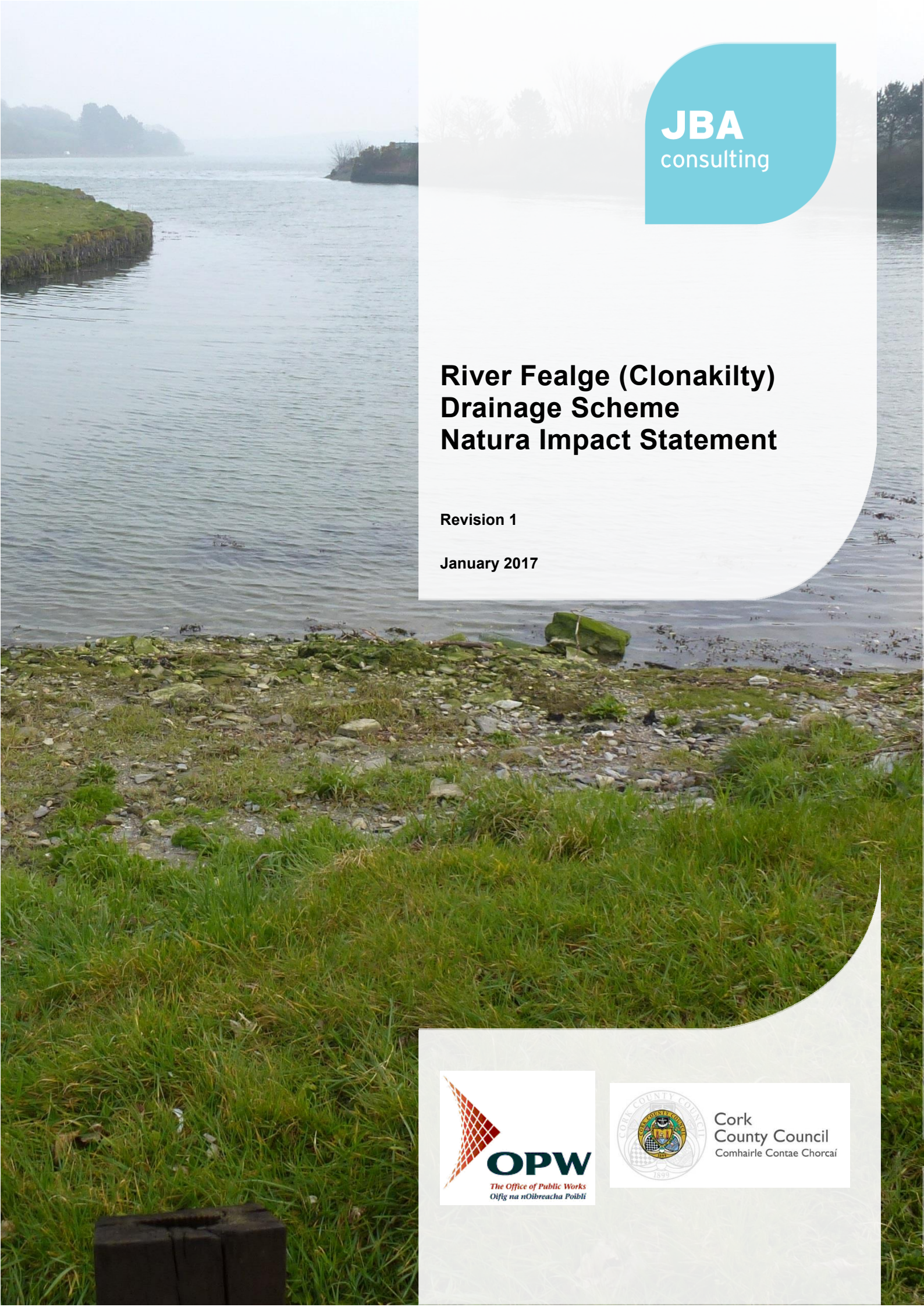

River Fealge (Clonakilty) Drainage Scheme Natura Impact Statement

Revision 1

January 2017

OPW
The Office of Public Works
Oifig na nOibreacha Poibli

Cork County Council
Comhairle Contae Chorcaí

JBA Project Manager

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Revision History

Revision Ref / Date Issued	Amendments	Issued to
Final Report / December 2014		Patrick McAlinney (OPW)
V5.0 / September 2015	Updates to section 4 in regarding further hydraulics assessment	Patrick McAlinney (OPW)
V7.0 / September 2015	Minor updates to hydrogeomorhpology and mitigation measures	Patrick McAlinney (OPW)
Revision 1 / January 2017	Update due to design changes and updated Natura 2000 site data	Patrick McAlinney (OPW)

Contract

This report describes work commissioned by the Office of Public Works. Laura Thomas, Declan Egan, Kieran Sheehan and Anne Murray of JBA Consulting carried out this work.

Final Report/ December 2014

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Revision 1 / January 2017

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Purpose

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Acknowledgements

JBA Consulting would like to thank Jervis Good, Patrick Graham and Declan O'Donnell from National Parks and Wildlife Service and Michael McPartland of Inland Fisheries Ireland for their input to this project.

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Executive Summary

The Office of Public Works is proposing to construct a flood relief scheme in the town of Clonakilty, Cork County. The preferred option principally involves construction of a fluvial storage area behind a storage embankment, construction of tidal defences around Clonakilty Bay and repair/construction of defences elsewhere within the town.

An Appropriate Assessment screening exercise (JBA Consulting, 2014) identified that the flood risk management measures that comprise the preferred option could result in potential adverse impacts on:

- Clonakilty Bay SAC (000091) which is designated for its estuarine and intertidal habitats including mudflats, sandflats, drift line vegetation and dune systems.
- Clonakilty Bay SPA (004081) which is designated for its overwintering bird populations, primarily Shelduck, Dunlin, Black-tailed Godwit and Curlew, along with the overall waterbird assemblage and wetland habitats.

This Natura Impact Statement (NIS) details the findings of the Stage 2 Appropriate Assessment conducted to further examine the potential direct and indirect impacts of the proposed River Fealge (Clonakilty) Drainage Scheme on the above Natura 2000 sites.

The Appropriate Assessment investigated the potential direct and indirect impacts of the proposed works on the integrity and interest features of the above Natura 2000 sites, alone and in-combination with other plans and projects, taking into account the structure, function and conservation objectives of each site. Potentially adverse impacts included physical damage of mudflat and sandflat habitats during the construction phase, disturbance of bird populations using the head of the estuary during the construction phase, water quality issues and pollution during the construction phase and changes to the physical and hydrological regime in the estuary as a result of operation of the scheme.

Where potentially significant adverse impacts were identified, a range of mitigation and avoidance measures have been suggested to help offset them. This includes appropriate timing of the works to avoid impacts on overwintering bird populations, ensuring permanent works do not encroach within the estuary and implementing appropriate pollution prevention control.

Potential in-combination effects with other plans, programmes and projects were also investigated including, ongoing OPW maintenance operations, construction of two additional pumping stations to discharge storm water into the estuary and other small-scale projects in the town.

As a result of this Appropriate Assessment it has been concluded that, ensuring the avoidance and mitigation measures are implemented as proposed, the River Fealge (Clonakilty) Drainage Scheme will not have a significant adverse impact on the above Natura 2000 sites.

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Abbreviations

AA	Appropriate Assessment
AEP	Annual Exceedance Probability
AFA	Area for Further Assessment
OD	Ordnance Datum (Malin)
CFRAM	Catchment-based Flood Risk Assessment and Management
DEHLG	Department of Environment, Heritage and Local Government
EIA	Environmental Impact Assessment
FRMP	Flood Risk Management Plan
GAA	Gaelic Athletic Association
IFI	Inland Fisheries Ireland
IROPI	Imperative Reasons of Over-riding Public Interest
I-WeBS	Irish Wetland Bird Survey
JBA	Jeremy Benn Associates
NIS	Natura Impact Statement
NPWS	National Parks and Wildlife Service
OPW	Office of Public Works
pNHA	Proposed Natural Heritage Area
PPG	Pollution Prevention Guidelines
RBMP	River Basin Management Plan
SAC	Special Area of Conservation
SEPA	Scottish Environment Protection Agency
SPA	Special Protection Area
SWCFRAM	South West Catchment-based Flood Risk Assessment and Management study
WMU	Water Management Unit
WWTP	Wastewater Treatment Works

1 Introduction

1.1 Background

JBA Consulting has been appointed by The Office of Public Works (OPW) to undertake Environmental Consultancy services in relation to the River Fealge (Clonakilty) Drainage Scheme in County Cork. This includes undertaking an Appropriate Assessment due to the presence of Clonakilty Bay Special Area of Conservation (SAC) and Special Protection Area (SPA) to the south-east of the town.

An initial Appropriate Assessment Screening was undertaken for the River Fealge (Clonakilty) Drainage Scheme as part of the South Western Catchment-based Flood Risk Assessment and Management (SW CFRAM) Study (Mott MacDonald, 2013a), followed by a project-specific screening exercise at the options appraisal stage (JBA Consulting, 2014). Due to the identification of potentially significant effects in relation to the selection option for the River Fealge (Clonakilty) Drainage Scheme (JBA Consulting, 2014), a Natura Impact Statement (NIS) was produced in 2014 to further assess the impacts on the integrity of the SAC and SPA, and devise appropriate avoidance and mitigation measures.

This NIS (Revision 1, January 2017) has been produced to include updates to the design of the Scheme.

1.2 Legislative Context

The Habitats Directive (Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora) aims to maintain or restore the favourable conservation status of habitats and species of community interest across Europe. The requirements of these directives are transposed into Irish law through the European Communities (Birds and Natural Habitats) Regulations) 2011 (S.I. No. 477 of 2011).

Under the Directive a network of sites of nature conservation importance have been identified by each Member State as containing specified habitats or species requiring to be maintained or returned to favourable conservation status. In Ireland the network consists of SACs and SPAs, and also candidate sites, which form the Natura 2000 network.

Article 6(3) of the Habitats Directive requires that, in relation to European designated sites (i.e. SACs and SPAs that form the Natura 2000 network), "*any plan or project not directly connected with or necessary to the management of the 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*".

A competent authority (e.g. the OPW or Local Authority) can only agree to a plan or project after having determined that it will not adversely affect the integrity of the site concerned.

Under article 6(4) of the Directive, if adverse impacts are likely, and in the absence of alternative options, a plan or project must nevertheless proceed for imperative reasons of overriding public interest (IROPI), including social or economic reasons, a Member State is required to take all compensatory measures necessary to ensure the overall integrity of the Natura 2000 site. The European Commission have to be informed of any compensatory measures adopted, unless a priority habitat type or species is present and in which case an opinion from the European Commission is required beforehand (unless for human health or public safety reasons, or of benefit to the environment).

1.3 Appropriate Assessment Process

Guidance on the Appropriate Assessment (AA) process was produced by the European Commission in 2002, which was subsequently developed into guidance specifically for Ireland by the Department of Environment, Heritage and Local Government (DEHLG) (2009). These guidance documents identify a staged approach to conducting an AA, as shown Figure 1-1.

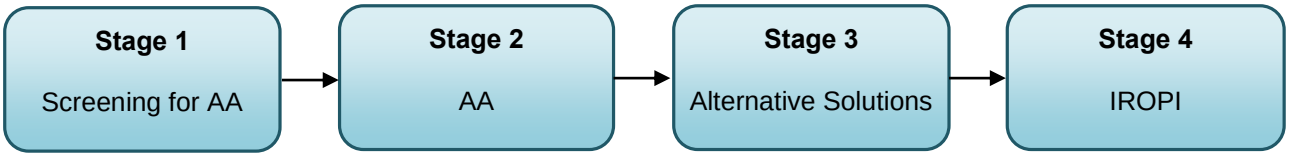


Figure 1-1: The Appropriate Assessment Process (from: Appropriate Assessment of Plans and Projects in Ireland - Guidance for Planning Authorities, DEHLG, 2009)

1.3.1 Stage 1 - Screening for AA

The initial, screening stage of the Appropriate Assessment is to determine:

a. whether the proposed plan or project is directly connected with or necessary for the management of the European designated site for nature conservation
b. if it is likely to have a significant adverse effect on the European designated site, either individually or in combination with other plans or projects

For those sites where potential adverse impacts are identified, either alone or in combination with other plans or projects, further assessment is necessary to determine if the proposals will have an adverse impact on the integrity of a European designated site, in view of the sites conservation objectives (i.e. the process proceeds to Stage 2).

1.3.2 Stage 2 - AA

This stage requires a more in-depth evaluation of the plan or project, and the potential direct and indirect impacts of them on the integrity and interest features of the European designated site(s), alone and in-combination with other plans and projects, taking into account the site's structure, function and conservation objectives. Where required, mitigation or avoidance measures will be suggested.

The competent authority can only agree to the plan or project after having ascertained that it will not adversely affect the integrity of the site(s) concerned. If this cannot be determined, and where mitigation cannot be achieved, then alternative solutions will need to be considered (i.e. the process proceeds to Stage 3).

1.3.3 Stage 3 - Alternative Solutions

Where adverse impacts on the integrity of Natura 2000 sites are identified, and mitigation cannot be satisfactorily implemented, alternative ways of achieving the objectives of the plan or project that avoid adverse impacts need to be considered. If none can be found, the process proceeds to Stage 4.

1.3.4 Stage 4 - IROPI

Where adverse impacts of a plan or project on the integrity of Natura 2000 sites are identified and no alternative solutions exist, the plan will only be allowed to progress if imperative reasons of overriding public interest can be demonstrated. In this case compensatory measures will be required.

The process only proceeds through each of the four stages for certain plans or projects. For example, for a plan or project, not connected with management of a site, but where no likely significant impacts are identified, the process stops at stage 1. Throughout the process, the precautionary principle must be applied, so that any uncertainties do not result in adverse impacts on a site.

1.4 Methodology

This NIS has been completed in line with *Appropriate Assessment of Plans and Projects in Ireland - Guidance for Planning Authorities* published by the Department of Environment, Heritage and Local Government (DEHLG) in 2009.

Data has been collected from a range of sources, including:

- A number of ecological surveys (see section 1.4.1).
- The SW CFRAM Study, in particular the initial Appropriate Assessment Screening Report for Clonakilty and other technical notes (Mott MacDonald, 2013a and 2013b).
- NPWS website (http://www.npws.ie/) where site synopses, Natura 2000 data forms and conservation objectives were obtained.
- The Environmental Impact Assessment for a previous tidal barrage scheme in the Bay (MCOS, 2001).

1.4.1 Ecological Surveys

To inform the Environmental Impact Assessment (EIA) for the flood relief scheme, and also this NIS, a number of assessments and ecological surveys have been conducted, including:

- An ecological desk-based assessment to collate information on designated sites and protected and notable species, including bird survey data from the waterbird survey programme and the Irish Wetland Bird Survey (I-WeBS).
- An ecological walkover survey conducted on 13th March 2014 which included mapping of habitats present within the study area, recording evidence of any protected species (e.g. Otter, Badger), a preliminary assessment of features with suitability for roosting bats and recording of any non-native invasive species found.
- A detailed bat survey focussing on those identified features with the potential to support roosting bats, involving daylight assessment of all identified features, timed night-time searches to monitor bat activity in the study area and deployment of static bat detectors. This was conducted between 20th and 22nd August 2014. An additional survey of trees and structures within new working areas was conducted on 10th and 11th December 2016.
- A crayfish survey of the River Fealge involved a snorkelling hand search and sweep netting, conducted between the 25th and 27th July 2014.
- A fish survey in the River Fealge undertaken between the 25th and 27th July 2014, which involved a habitat assessment, assessment of habitat suitability for macro-invertebrates and an electro-fishing survey at four survey points. An additional fish habitat survey of the new working areas (River Fealge, Ballyhalwick Stream, Garage Stream and Convent Stream) was conducted in January 2017 by Triturus Environmental Services.

The results of these surveys have informed this NIS where relevant.

1.4.2 Consultation

During development of the River Fealge (Clonakilty) Drainage Scheme and production of this NIS consultation meetings were held with the National Parks and Wildlife Service (NPWS) and Inland Fisheries Ireland (IFI); their recommendations have been incorporated into this assessment, in particular in relation to survey methodology. Appendix A contains the response from The Department of Arts, Heritage and the Gaeltacht.

2 Description of Proposals

2.1 Background

The OPW, working in partnership with Cork County Council and other Local Authorities, have commissioned the SW CFRAM Study to identify, assess and map existing and potential future flood risk in the study area, identify viable measures for the effective and sustainable management of flood risk in specified Areas for Further Assessment (AFAs) and prepare Flood Risk Management Plans (FRMPs). There are 26 AFAs in the SW CFRAM Study Area, including Clonakilty. Following severe flooding of the town in 2012, the CFRAM work for the town was accelerated to assess the risk and develop a potentially viable flood relief scheme as a priority.

Throughout 2014 the River Fealge (Clonakilty) Drainage Scheme has been in development. A number of flood risk management measures were assessed, and a preferred option selected involving construction of a fluvial storage area upstream of the town, construction of tidal flood defences and repair/construction of fluvial defence walls within the town. Further details of the selected option are provided in section 2.2 below.

2.2 Details of Proposed Flood Relief Scheme

The SW CFRAM study identified the study area for the River Fealge (Clonakilty) Drainage Scheme to include:

- The upper reaches of the Garage Stream
- The Cappeen Stream
- The River Fealge including its tributaries, the Ahagilla Stream, Ballyhalwick Stream and Ballyvackey Stream.

Figure 2-1 illustrates the River Fealge (Clonakilty) Drainage Scheme study area.

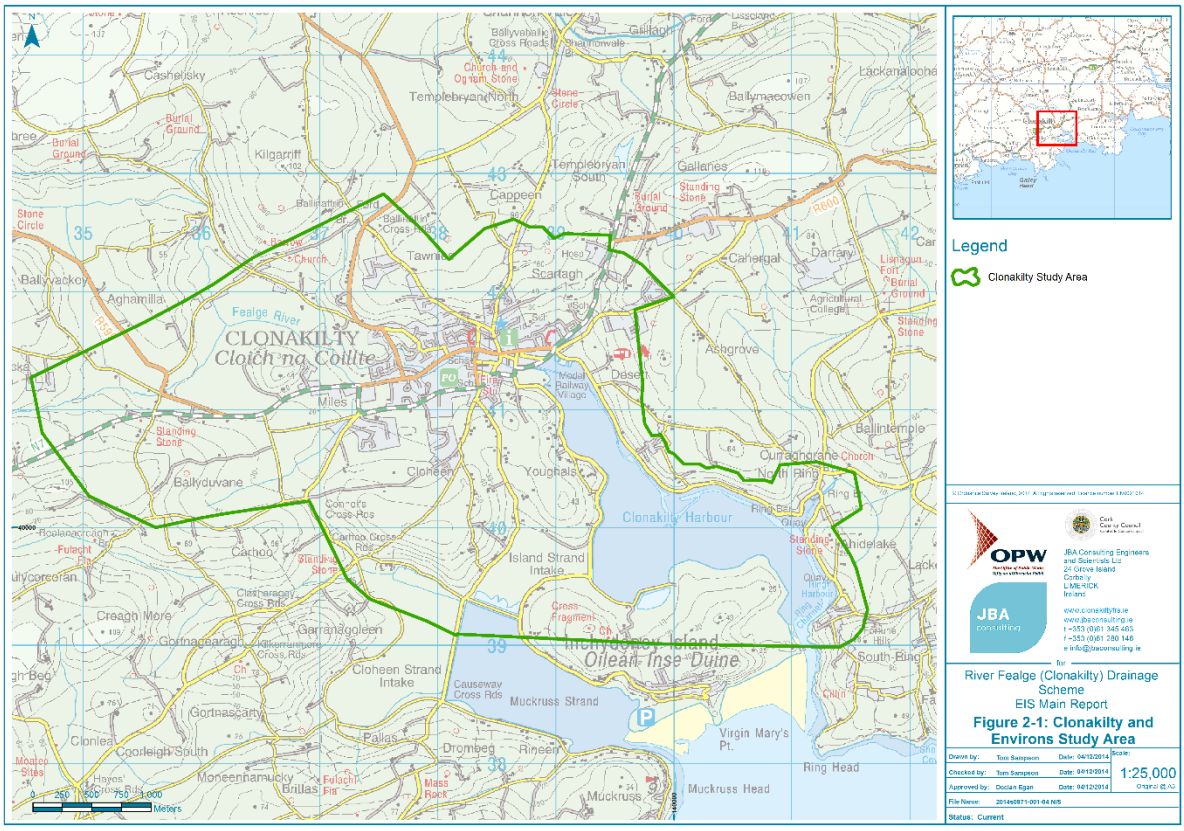


Figure 2-1: Clonakilty study area

The flood risk management measures considered by the design engineers involved a combination of probability and design based on the following scenario:

- Fluvial Design Event - 1% Fluvial Annual Exceedance Probability (AEP) + 0.7 year tide with surge (2.13mOD)

2.3 Fluvial Storage

The primary element of the drainage scheme is the provision of a storage reservoir that will hold the flood water and allow it to be released at rates that will not over top the river banks in the town. The storage reservoir comprises agricultural land to the west of Dunne's Stores. Based on the modelling it was calculated that the permitted flow through the town would be 6.3 m^3/s. For this outflow the top of the flood embankment is 13.9m AOD (i.e. 13.4m contour plus 0.5m allowance for freeboard and settlement of the embankment). An overspill provision is set at a height of 300mm less than the top of the embankment. The height of the embankment over the river is 5.6m. The storage reservoir is calculated at approx. 186,500m^2.

The Clonakilty Town Development Plan 2009-2015 allows for the construction of a North Ring Road around the town. A section of the proposed bypass would run through the storage area. The volume of the bypass is estimated at 21,500m^3. Therefore, the required storage volume for the storage reservoir was increased by a similar volume. The storage area of the storage reservoir is now set at 194,900m^2. The design and layout of the embankment is based on the hydraulic modelling conducted for this scheme. The embankment will have a 3 m wide sluice to control the flow of water from the storage reservoir into the river. The sluice will be situated between two concrete uprights and the height of the sluice will be manually controlled. The sluice control will be operated manually and the operator will be informed by a number of water level metres within the catchment.

Approximately 11,250 m^3 of impermeable material will be used to construct the embankment.

This measure does not mitigate upstream fluvial floods risk. Consequently, some minor fluvial defence measures (embankments and flood walls) would be required at Killgarrif Bridge, the Garage Stream and on the Ballyhalwick Stream.

The location of the storage embankment and the storage area, an elevation of the storage embankment and a section through the embankments are shown in Figure 2-6, Figure 2-8 and Figure 2-9.

2.4 Tidal Flood Defences

The River Fealge is tidally influenced up to Bushmount Nursing Home. To protect the town from tidal flooding a number of tidal defences will be constructed. The tidal defences will comprise either walls or embankments. The original proposed defences are outlined below and any revised interferences are detailed directly afterwards. Section 2.4.1 details new interferences to the tidal flood defences of the Scheme.

The proposed tidal defence works are shown in Figures 2-2 to 2-5 and described in detail below.

- **L38-L42 -** 1.3m high flood walls behind a number of properties on Convent Road. This section of the work will involve the repair and replacement of the existing wall. All of the works will be carried out at ground level.

  L38-L42 - Revised Interference: Excavate channel and install u-shaped channel with reinforced concrete walls 1.3m high. These works will involve instream works in the Convent Stream and bankside works.

- **E10** - A 1.4m high flood embankment behind the houses on the Old Timoleague Road. This new embankment will be constructed of impermeable material transported to the site. The south western end of the embankment will tie into the Ring Road. The embankment will be 60 m long and it is estimated that approximately 150m^3 of material (equivalent to approximately 300 tonnes) will be required to construct the embankment.

  E10 - Revised Interference: Excavated topsoil and construct embankment up to 1.4m high to 3.34m AOD. Revised layout and location of the embankment in the farmer's land beside the Ring Road.

- **R1** -1.6m high flood wall and 1.7m raised road level along 220m of the Ring Road from Facksbridge. The south-eastern end of the flood wall will tie into the Ring Road opposite the embankment at the rear of the houses along the Old Timoleague Road. The Ring Road will be raised to 1.7m along a 220m section of it.
- **L36** - 1.1m to 1.3m high flood walls along Croppy Road between Clarke Street and Facksbridge. This defence wall will be constructed on the embankment beside the Croppy Road footpath. The wall will consist of either brick or poured concrete faced with local stone. All work will be carried out on land.
- **L30-L35 -** 1.2m high flood walls from Clarke Street along the south bank, through the Waterfront Development to boundary of Waste Water Treatment Plant. These defence walls will be reinforced concrete and some in-river works will be required. A cofferdam will be constructed around the work area.

  L30, L31 and L35 - Revised Interference: Revised location and registered owner. Excavate for foundations and construct reinforced concrete wall 1.3m high. The proposed wall at the Waterfront development (L35) will be reduced from 255m to 50m in length.
- **E9** - 0.75m high flood defence embankment at boundary of Waterfront Development and the Waste Water Treatment Plant. The embankment will run north-south tying into existing ground levels. The embankment will tie into the defence wall running along the south bank of the estuary at Croppy Road.
- **B7** - Strengthen and raise parapets of Clarke's Street Bridge. The parapets on Clarke's Street Bridge will be reinforced. All works will be constructed at ground level.
- **B6** - Replace railings with solid parapets in Seymour Street Pedestrian Bridge. The railings on the Seymour Street Pedestrian Bridge will be removed and replaced will a solid concrete parapet. The parapets will be constructed to a minimum height of 1.1m.
- **L32-L34** - 1.3m high flood walls on both banks between Seymour Street Pedestrian Bridge and Clarke Street Bridge. The existing flood defence walls along the south bank of the river are in good condition but will need to be raised to 1.3m. The existing walls on the north bank of the river are in fair to very poor condition. The section of walls in poor condition will need to be repaired/replaced. In river works will be required at this location. A cofferdam will be installed around the work area.
- **L25-L29** - 1.1m -1.3m high flood walls on both banks of the river between Rossa Street Bridge and Seymour Street Pedestrian Bridge. The walls on the north bank of the river will be replaced. A cofferdam will be installed to complete the works.
- **L21-L24** - 1.1m high flood walls on both banks between Library and Rossa Street Bridge. There are existing walls at this location but these walls are in poor condition. For the purposes of this NIS it is assumed that these walls will be replaced. In river works will be required and a cofferdam will be put in place for the construction.
- **L16-L19** - 1.1m high flood walls on both banks between Michael Collins Bridge and the Library. This will involve some construction and repair of the existing walls. In river works and a cofferdam will be required.
- Other works that will be required includes:
- Ballyhalwick Stream: 1.1m headwall upstream of L8010 Bridge and 0.6m high embankment and wall along both banks downstream of R599 Bridge
- A flood embankment at Killgarriff Bridge.

2.4.1 New Interference of Tidal Flood Defences

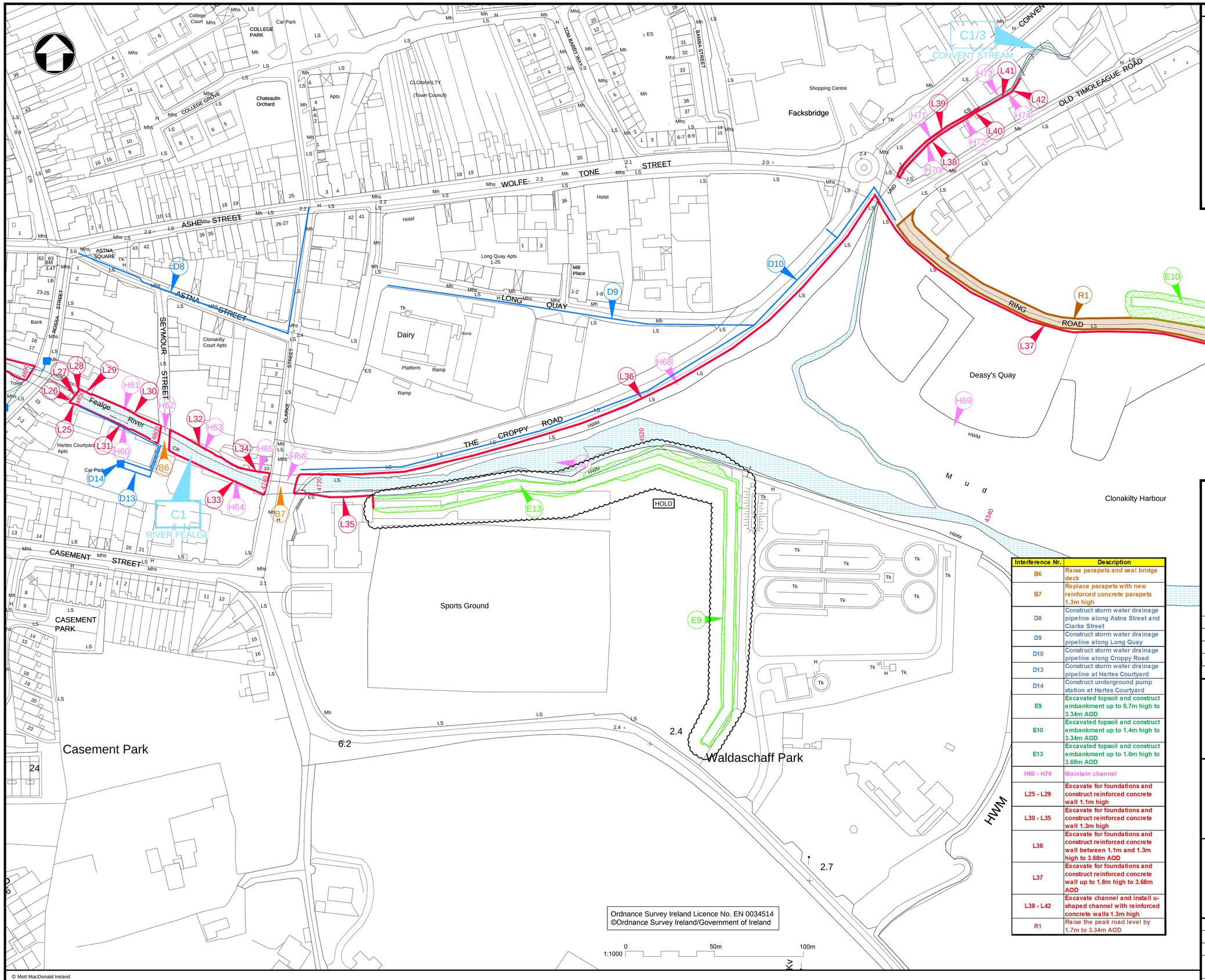
- **E13** - Excavated topsoil and construct embankment up to 1.0m high to 3.68m AOD. The embankment will be located at the Waterfront development instead of the proposed wall (L35). Replacement of the proposed wall by an embankment. Height of embankment approx. 1 m with a setback distance of 3 m from the water's edge. Length of embankment 205m.

2.5 Underground Pumping Stations

Underground pumping stations will be installed in the town to ensure that rainwater that falls behind the defences will not cause a flood risk. Cork County Council will be responsible for the installation and operation of two of these pumping stations located at Croppy Road and at the former GAA pitch; these two pumping stations are therefore not considered part of the River Fealge (Clonakilty) Drainage Scheme, however the impact of potential in-combination effects will be considered in this NIS. Additional pumping stations will be installed as part of the River Fealge (Clonakilty) Drainage Scheme at Rossa Street and Kent Street. All of the pumping stations will be below ground level. The location of the pumping stations is shown in Figure 2-7 and described below.

- D11 - An underground pumping station at Croppy Road (not part of the River Fealge (Clonakilty) Drainage Scheme)
- D12 - An underground pumping station at the old GAA grounds (not part of the River Fealge (Clonakilty) Drainage Scheme)
- D7 - An underground pumping station at Rossa Street
- D5 - An underground pumping station at Kent Street Car Park

Figure 2-2: Interference drawing 1 of 8



Notes

KEY PLAN
Scale NTS

CONFIRMATION COPY

Interference Nr.	Description
B6	Raise parapets and seal bridge deck
B7	Replace parapets with new reinforced concrete parapets 1.3m high
D8	Construct storm water drainage pipeline along Astna Street and Clarke Street
D9	Construct storm water drainage pipeline along Long Quay
D10	Construct storm water drainage pipeline along Croppy Road
D13	Construct storm water drainage pipeline at Hartes Courtyard
D14	Construct underground pump station at Hartes Courtyard
E9	Excavated topsoil and construct embankment up to 0.7m high to 3.34m AOD
E10	Excavated topsoil and construct embankment up to 1.4m high to 3.34m AOD
E13	Excavated topsoil and construct embankment up to 1.0m high to 3.68m AOD
H60 - H74	Maintain channel
L25 - L29	Excavate for foundations and construct reinforced concrete wall 1.1m high
L30 - L35	Excavate for foundations and construct reinforced concrete wall 1.3m high
L36	Excavate for foundations and construct reinforced concrete wall between 1.1m and 1.3m high to 3.68m AOD
L37	Excavate for foundations and construct reinforced concrete wall up to 1.8m high to 3.68m AOD
L38 - L42	Excavate channel and install u-shaped channel with reinforced concrete walls 1.3m high
R1	Raise the peak road level by 1.7m to 3.34m AOD

Legend:

- EMBANKMENT
- REPAIR / REPLACE CHANNEL WALL
- MAINTAIN CHANNEL
- BRIDGE REPAIR
- SURFACE WATER SEWER
- PUMP STATION
- ROAD LEVEL ADJUSTED

Rev	Date	Drawn	Description	Ch'k'd	App'd
P4	.2016	DGal	For Information	TDon	BOC
P3	21.09.2016	DGal	For Information	TDon	BOC
P2	08.12.2014	DGal	For Information	TDon	BOC
P1	26.11.2014	DGal	For Information	TDon	BOC

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Jonathan Swift Street
Trim
Co. Meath

Title
River Fealge (Clonakilty)
Certified Drainage Scheme

Proposed Flood Defence Works
Scheme Layout (1 of 8)

Designed	-		Eng check	T Donovan	
Drawn	D Gallagher		Coordination	-	
Dwg check	-		Approved	B O'Connor	

Scale at A1	Status	Rev	Security
1:1000	PRE	P4	STD

Drawing Number
MMD-332149-N-DR-00-XX-0004

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Figure 2-3: Interference drawing 2 of 8

Interference Nr.	Description
B1, B4, B5	Repair / replace existing bridge parapet 1.1m high
B2, B3	Replace railings with solid bridge parapets 1.1m high
D1	Construct storm water drainage pipeline along Kent Street
D2	Construct storm water drainage pipeline along Connelly Street
D3	Construct underground pumping station on Kent Street with outfall to river
D4	Construct storm water drainage pipeline in Kent Street Car Park
D5	Construct underground pumping station in Kent Street Car Park with outfall to river
D7	Construct underground pumping station on Rossa Street with outfall to river
G 17	Infill of gaps and low points in river bank
H26 - H59	Maintain channel
L8 - L15	Repair / replace existing channel wall / bank
L16 - L24	Excavate for foundations and construct reinforced concrete wall 1.1m high
L45, L46, L47	Repair / replace existing channel wall

Notes

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Scale NTS

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Legend:

- REPAIR / REPLACE CHANNEL WALL
- MAINTAIN CHANNEL
- BRIDGE REPAIR
- SURFACE WATER SEWER
- PUMP STATION

CONFIRMATION COPY

0 1:1000 50m 100m

Rev	Date	Drawn	Description	Ch'k'd	App'd
P3	21.09.2016	DGal	For Information	TDon	BOC
P2	08.12.14	DGal	For Information	TDon	BOC
P1	26.11.2014	DGal	For Information	TDon	BOC

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Title
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Certified Drainage Scheme

Proposed Flood Defence Works
Scheme Layout (2 of 8)

Designed	-		Eng check	T Donovan	
Drawn	D Gallagher		Coordination	-	
Dwg check	-		Approved	B O'Connor	
Scale at A1	Status		Rev	Security	
1:1000	PRE		P3	STD	

Drawing Number
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Figure 2-4: Interference drawing 3 of 8

Interference Nr.	Description
H4	Regrade channel for flow control structure and spillway
H5 - H28	Maintain channel
L4 - L8	Repair / replace existing channel wall
L43, L44, L45	Repair / replace existing channel wall

Notes

KEY PLAN

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Legend:

REPAIR / REPLACE WALLS

MAINTAIN CHANNEL

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1:1000 0 50m 100m

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P4	.2016	DGal	For Information	TDon	BOC
P3	21.09.2016	DGal	For Information	TDon	BOC
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Figure 2-5: Interference drawing 4 of 8

Interference Nr.	Description
G8, G9	Replace 2Nr. existing culverts under the road with a single culvert structure
G10, G11	Install trash screen in river channel
R2	Construct access road and site entrance for access to trash screen

Notes

KEY PLAN
Scale NTS

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Legend:

REPLACE CULVERT
TRASH SCREEN
ACCESS ROAD

CONFIRMATION COPY

1:1000 0 50m 100m

Rev	Date	Drawn	Description	Ch'k'd	App'd
P4	.2016	DGal	For Information	TDon	BOC
P3	21.09.2016	DGal	For Information	TDon	BOC
P2	08.12.2014	DGal	For Information	TDon	BOC
P1	26.11.2014	DGal	For Information	TDon	BOC

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Figure 2-6: Interference drawing 5 of 8

Area Flooded during Fluvial Events (m2)						
Interference Nr.	50% AEP	20% AEP	10% AEP	5% AEP	2% AEP	1% AEP
G1	0.00	2,554.86	6,204.81	15,243.18	30,080.51	41,989.56
G2	466.54	16,149.00	20,241.63	30,621.11	44,970.54	55,447.94
G3	9,587.74	19,462.87	20,741.18	22,449.71	24,292.74	25,563.71
G4	4,421.55	10,383.36	11,221.01	12,796.43	15,857.78	18,170.73
G5	18,482.60	20,492.62	20,958.46	21,709.23	22,381.50	22,748.31
G6	6,592.52	8,705.28	9,000.74	9,621.74	10,188.38	10,480.80
G7	8,576.31	10,849.21	10,968.39	11,014.23	11,017.57	11,017.57

Interference Nr.	Description
G1 - G7	Increasing extent and depth of flooding during flood event
E6	Excavated topsoil and construct embankment up to 6.1m high to 14.6m AOD
E7	Excavated topsoil and construct embankment up to 6.1m high to 14.6m AOD
E8	Excavated topsoil and construct embankment up to 6.1m high to 14.6m AOD
H1, H2	Regrade channel for flow control structure
H3	Construct overflow spillway from embankment and flow control structure
H4	Regrade channel for flow control structure and spillway
H5	Maintain channel
SI1, SI2	Construct reinforced concrete flow control structure for penstock

Notes

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Legend:

EMBANKMENT

SLUICE GATE

SPILLWAY

1% AEP STORAGE AREA OUTLINE

CONFIRMATION COPY

1:1000 0 50m 100m

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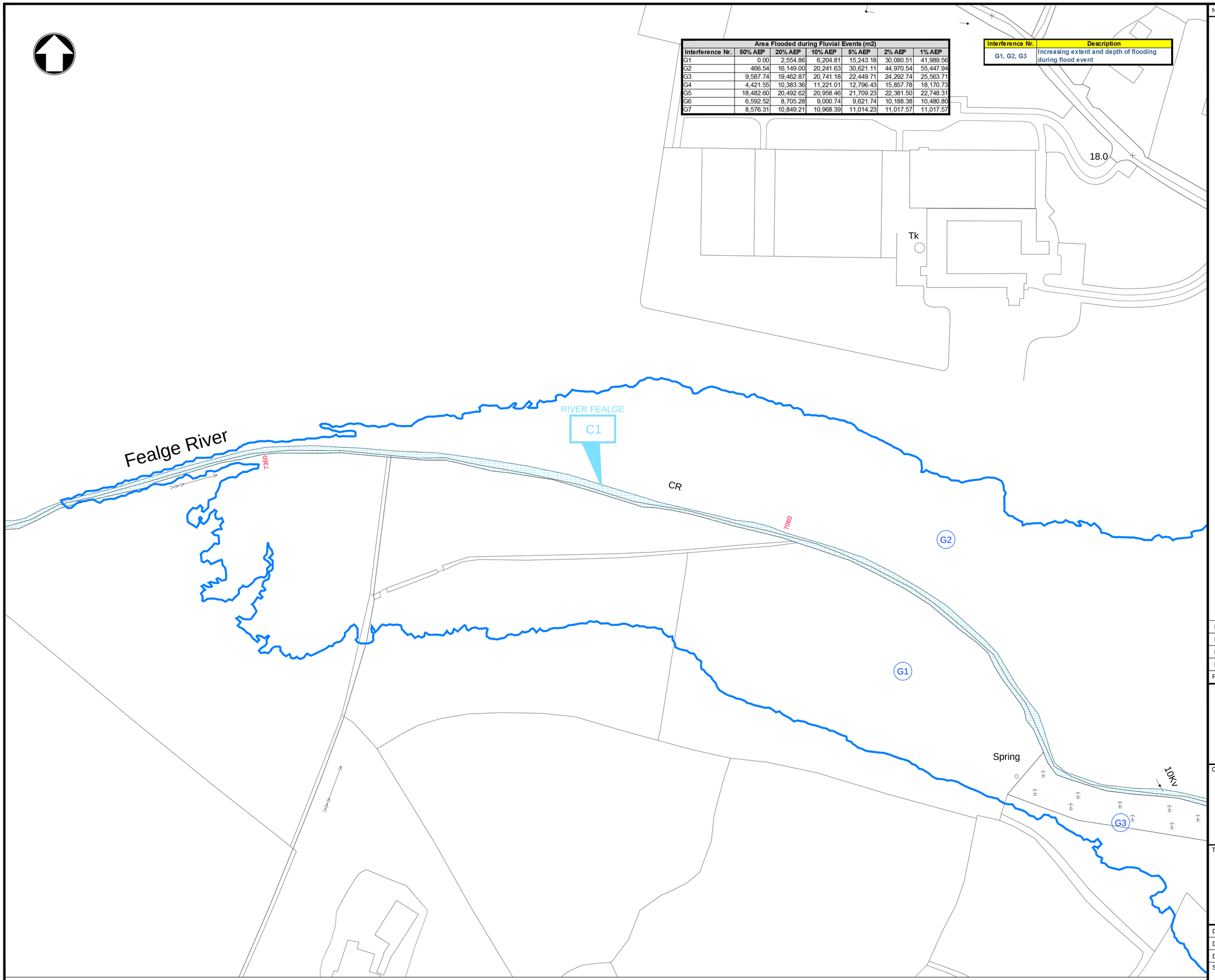
Figure 2-7: Interference drawing 6 of 8

Area Flooded during Fluvial Events (m2)						
Interference Nr.	50% AEP	20% AEP	10% AEP	5% AEP	2% AEP	1% AEP
G1	0.00	2,554.86	6,204.81	15,243.18	30,080.51	41,989.56
G2	466.54	16,149.00	20,241.63	30,621.11	44,970.54	55,447.94
G3	9,587.74	19,462.87	20,741.18	22,449.71	24,292.74	25,563.71
G4	4,421.55	10,383.36	11,221.01	12,796.43	15,857.78	18,170.73
G5	18,482.60	20,492.62	20,958.46	21,709.23	22,381.50	22,748.31
G6	6,592.52	8,705.28	9,000.74	9,621.74	10,188.38	10,480.80
G7	8,576.31	10,849.21	10,968.39	11,014.23	11,017.57	11,017.57

Interference Nr.	Description
G1, G2, G3	Increasing extent and depth of flooding during flood event



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Legend:

1% AEP STORAGE AREA OUTLINE

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Figure 2-8: Interference drawing 7 of 8

Interference Nr.	Description
E11	Excavate topsoil and construct embankment up to 1.0m high to 16.5m AOD
G12 / G18	Remove existing ditch / hedging and replace with timber post and rail fence and gate

27.6
17.8
17.3
17.3
16.8
CR
7940
C1
RIVER FEALGE
G12
7820
G18
E11
CR
7570
Fealge River

Notes

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Legend:

EMBANKMENT

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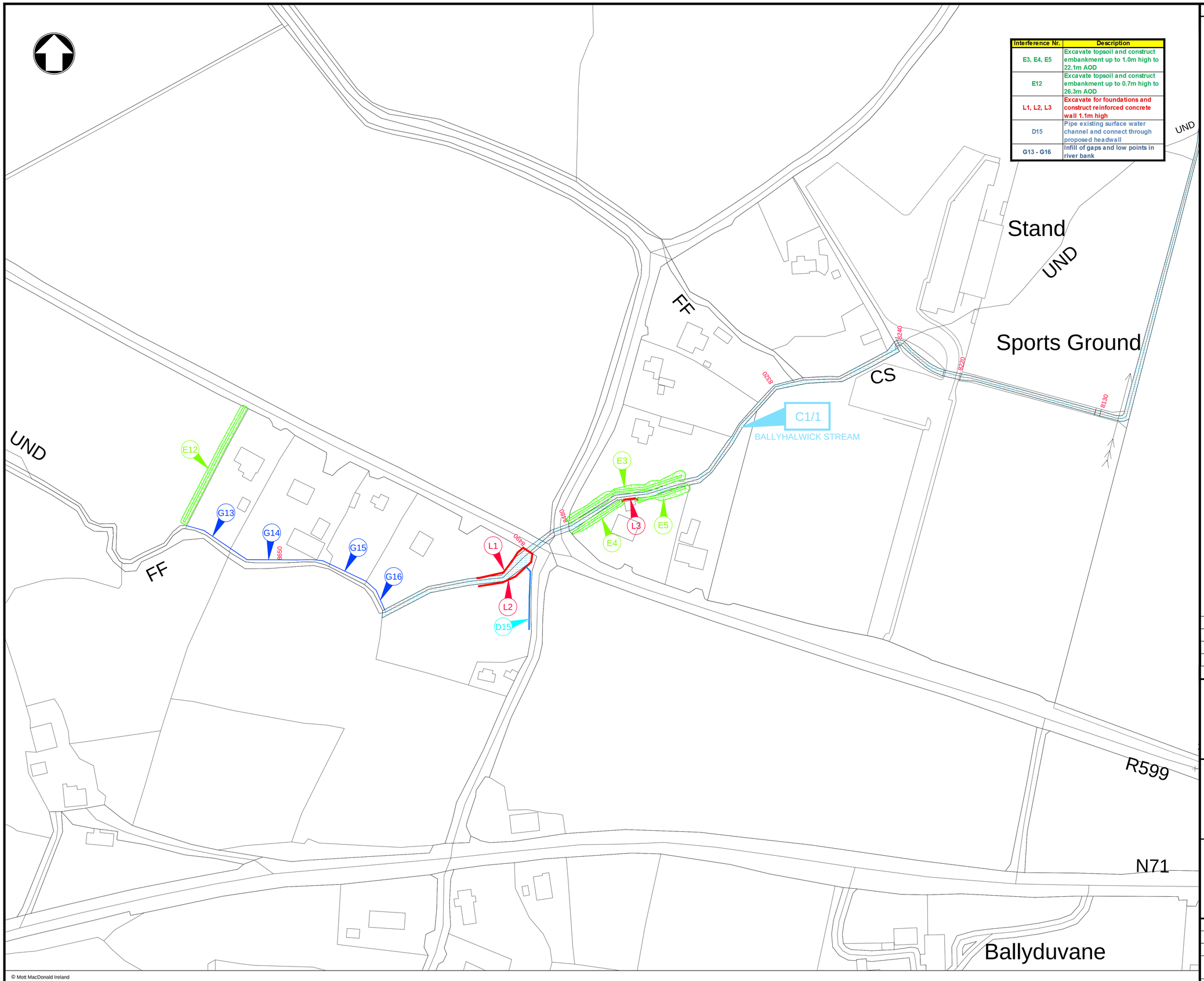
Figure 2-9: Interference drawing 8 of 8

Interference Nr.	Description
E3, E4, E5	Excavate topsoil and construct embankment up to 1.0m high to 22.1m AOD
E12	Excavate topsoil and construct embankment up to 0.7m high to 26.3m AOD
L1, L2, L3	Excavate for foundations and construct reinforced concrete wall 1.1m high
D15	Pipe existing surface water channel and connect through proposed headwall
G13 - G16	Infill of gaps and low points in river bank



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Legend:

EMBANKMENT

REINFORCED CONCRETE WALL

SURFACE WATER SEWER

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P3	21.09.2016	DGal	For Information	TDon	BOC
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3 Natura 2000 Sites within the Zone of Influence of the Scheme

3.1 Introduction

This chapter provides baseline information on the Natura 2000 sites within the Zone of Influence of the flood relief scheme. The Appropriate Assessment Screening Report (JBA Consulting, 2014) identified that two Natura 2000 sites could be impacted upon by the scheme; Clonakilty Bay SAC and Clonakilty Bay SPA, which are shown in Figure 3-1.

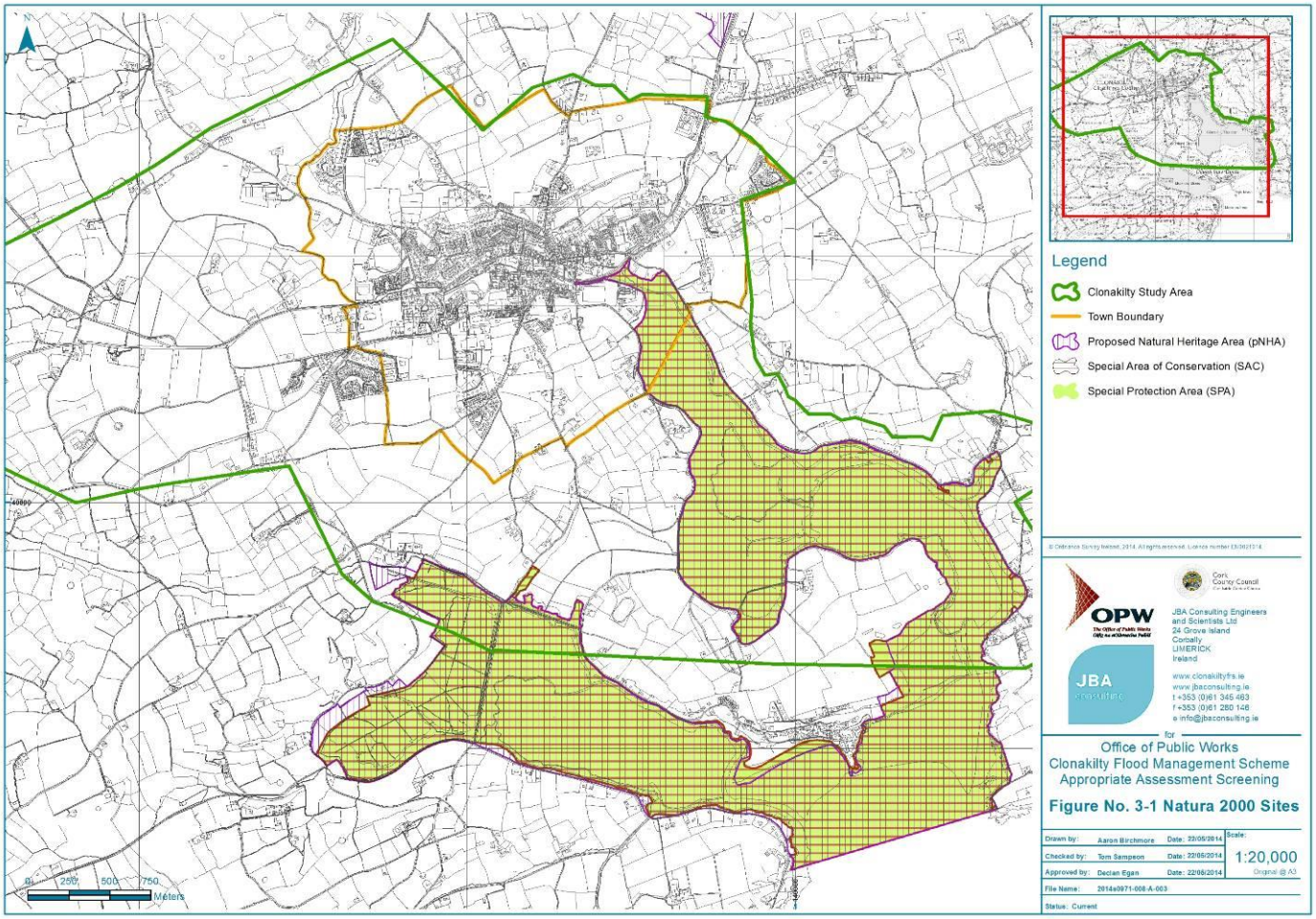

Figure 3-1: Natura 2000 sites in and around the Clonakilty Study Area

A short description for each site is provided below, along with details of the qualifying interest/special conservation interests, conservation objectives, the attributes and targets used to define favourable conservation status and site vulnerabilities.

3.2 Clonakilty Bay SAC [000091]

Clonakilty Bay SAC is an inter-tidal expanse that stretches from Clonakilty to the open sea comprising two small estuaries separated by Inchydoney Island with adjacent sand dunes and inland marshes. This coastal complex has a good diversity of habitats including several habitats listed on Annex I of the EU Habitats Directive. The habitats show a succession from salt to freshwater influences including sandflats, mudflats, sand dunes, wetland, including saline lagoons, to brackish grasslands, open freshwater marsh and Alder *Alnus glutinosa* scrub. The value of the SAC is enhanced by the bird life that it supports (NPWS, 2013).

3.2.1 Special Conservation Interests and Conservation Objectives

Table 3-1: Qualifying Interests and associated Conservation Objectives of Clonakilty Bay SAC

Code	Qualifying Interest	Attribute (From: NPWS, 2014b)	Target (From: NPWS, 2014b)
To maintain the favourable conservation condition of Mudflats and sandflats not covered by seawater at low tide in Clonakilty Bay SAC			
1140	Mudflats and sandflats not covered by seawater at low tide	Habitat area	The permanent habitat area is stable or increasing, subject to natural processes
		Community distribution	Conserve the following community type in a natural condition: Sand to sandy mud with *Tubificoides benedii* and *Peringia ulvae* community complex
To maintain the favourable conservation condition of Annual vegetation of drift lines in Clonakilty Bay SAC			
1210	Annual vegetation of drift lines	Habitat area	Area stable or increasing, subject to natural processes, including erosion and succession
		Habitat distribution	No decline, or change in habitat distribution, subject to natural processes
		Physical structure: functionality and sediment supply	Maintain the natural circulation of sediment and organic matter, without any physical obstructions
		Vegetation structure: zonation	Maintain the range of coastal habitats including transitional zones, subject to natural processes including erosion and succession
		Vegetation composition: typical species and subcommunities	Maintain the presence of species-poor communities with typical species: Sea Rocket *Cakile maritima*, Sea Sandwort *Honckenya peploides*, Prickly Saltwort *Salsola kali* and orache *Atriplex spp.*
		Vegetation composition: negative indicator species	Negative indicator species (including non-natives) to represent less than 5% cover
To maintain the favourable conservation condition of Embryonic shifting dunes in Clonakilty Bay SAC			
2110	Embryonic shifting dunes	Habitat area	Area stable or increasing, subject to natural processes, including erosion and succession.
		Habitat distribution	No decline, subject to natural processes.
		Physical structure: functionality and sediment supply	Maintain the natural circulation of sediment and organic matter, without any physical obstructions
		Vegetation structure: zonation	Maintain the range of coastal habitats including transitional zones, subject to natural processes including erosion and succession
		Vegetation composition: typical species and subcommunities	More than 95% of Sand Couch Grass *Elytrigia juncea* and/or Lyme Grass *Leymus arenarius* should be healthy (i.e. green plant parts above ground and flowering heads present)
		Vegetation composition: negative indicator species	Maintain the presence of species-poor communities with typical species: Sand Couch Grass *Elytrigia juncea* and/or Lyme Grass *Leymus arenarius*
		Vegetation composition: negative indicator species	Negative indicator species (including non-native species) to represent less than 5% cover

Code	Qualifying Interest	Attribute (From: NPWS, 2014b)	Target (From: NPWS, 2014b)
To maintain the favourable conservation condition of Shifting dunes along the shoreline with Ammophila arenaria ('white dunes') in Clonakilty Bay SAC			
2120	Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes)	Habitat area	Area stable or increasing, subject to natural processes including erosion and succession.
		Habitat distribution	No decline, or change in habitat distribution, subject to natural processes
		Physical structure: functionality and sediment supply	Maintain the natural circulation of sediment and organic matter, without any physical obstructions
		Vegetation structure: zonation	Maintain the range of coastal habitats including transitional zones, subject to natural processes including erosion and succession
		Vegetation composition: plant health of dune grasses	95% of Marram Grass *Ammophila arenaria* and/or Lyme Grass *Leymus arenarius* should be healthy (i.e. green plant parts above ground and flowering heads present)
		Vegetation composition: typical species and subcommunities	Maintain the presence of species-poor communities dominated by Marram Grass *Ammophila arenaria* and/or Lyme Grass *Leymus arenarius*
		Vegetation composition: negative indicator species	Negative indicator species (including non-natives) to represent less than 5% cover
To restore the favourable conservation condition of Fixed coastal dunes with herbaceous vegetation ('grey dunes') in Clonakilty Bay SAC			
2130	Fixed coastal dunes with herbaceous vegetation (grey dunes)	Habitat area	Area stable or increasing, subject to natural processes including erosion and succession.
		Habitat distribution	No decline, or change in habitat distribution, subject to natural processes
		Physical structure: functionality and sediment supply	Maintain the natural circulation of sediment and organic matter, without any physical obstructions
		Vegetation structure: zonation	Maintain the range of coastal habitats including transitional zones, subject to natural processes including erosion and succession
		Vegetation structure: bare ground	Bare ground should not exceed 10% of fixed dune habitat, subject to natural processes
		Vegetation structure: sward height	Maintain structural variation within sward
		Vegetation composition: typical species and subcommunities	Maintain range of subcommunities with typical species listed in Delaney *et al.* (2013)
		Vegetation composition: negative indicator species	Negative indicator species (including non-natives) to represent less than 5% cover
		Vegetation composition: scrub/trees	No more than 5% cover or under control
To maintain the favourable conservation condition of Atlantic decalcified fixed dunes (Calluno-Ulicetea) in Clonakilty Bay SAC			
2150	Atlantic decalcified fixed dunes (*Calluno-Ulicetea*)	Habitat area	Area stable or increasing, subject to natural processes including erosion and succession
		Habitat distribution	No decline or change in habitat distribution, subject to natural processes
		Physical structure: functionality and	Maintain the natural circulation of sediment and organic matter, without

Code	Qualifying Interest	Attribute (From: NPWS, 2014b)	Target (From: NPWS, 2014b)
		sediment supply	any physical obstructions
		Vegetation structure: zonation	Maintain the range of coastal habitats including transitional zones, subject to natural processes including erosion and succession
		Vegetation structure: bare ground	Bare ground should not exceed 10% of fixed dune habitat, subject to natural processes
		Vegetation structure: sward height	Maintain structural variation within sward
		Vegetation composition: typical species and subcommunities	Maintain range of subcommunities with typical species listed in Delaney *et al.* (2013)
		Vegetation composition: negative indicator species	Negative indicator species (including non-natives) to represent less than 5% cover
		Vegetation composition: scrub/trees	No more than 5% cover or under control

It should also be noted that the site is known to support a number of species listed on Annex II of the Directive, including Otter *Lutra lutra* [1135] and a number of fish species which will pass through the bay into the River Fealge, including Atlantic Salmon *Salmo salar* [1106] and River Lamprey *Lampetra fluviatilis* [1109]. However, the site is not specifically designated for these species. Furthermore, the River Fealge is considered to support a vegetation community equivalent to the Annex I habitat of Watercourses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation.

Clonakilty Bay SAC is designated for habitats only, and the NPWS (2014b) have identified a number of attributes and targets for each of the above habitats which define, on a site-specific basis, favourable condition. In summary, favourable conservation status of a habitat is achieved when:

- its natural range, and area it covers within that range, are stable or increasing, and
- the specific structure and functions which are necessary for its long-term maintenance exist and are likely to continue to exist for the foreseeable future, and
- the conservation status of its typical species is favourable.

The favourable conservation status of a species is achieved when:

- population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats, and
- the natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future, and
- there is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis.

3.2.2 Site Vulnerability

The Natura 2000 Data Form (NPWS, 2015a) identifies that increasing recreational pressure poses the most serious threat to the stability and structure of the sand dunes. Land claim is also a threat to the bay. Some pollution is likely to be entering the bay from Clonakilty town and surrounding agricultural lands (NPWS, 2015a).

3.3 Clonakilty Bay SPA [004081]

Clonakilty Bay SPA, covering the same area as the SAC, is a wetland complex that stretches from the town of Clonakilty to the open sea. Several small rivers, including the River Fealge flow into the site. The site is valued for its ornithological importance, particularly for the internationally significant population of Black-tailed Godwit *Limosa limosa* that it supports in winter. Further to this, the SPA supports nationally important numbers of four other species, namely: Shelduck

Tadorna tadorna, Dunlin *Calidris alpina*, Curlew *Numenius arquata* and Greenshank *Tringa nebulara* (NPWS, 2014c).

3.3.1 Special Conservation Interests and Conservation Objectives

Table 3-2: Special Conservation Interests of Clonakilty Bay SPA

Code	Qualifying Interest	Attribute	Target	Comment
To maintain the favourable conservation condition of Shelduck in Clonakilty Bay SPA, which is defined by the following list of attributes and targets:				
A048	Shelduck *Tadorna tadorna*	Population trend	Long term population trend stable or increasing	The site supports nationally important numbers of this species.
		Distribution	No significant decrease in the range, timing or intensity of use of areas by Shelduck, other than that occurring from natural patterns of variation	
To maintain the favourable conservation condition of Dunlin in Clonakilty Bay SPA, which is defined by the following list of attributes and targets:				
A149	Dunlin *Calidris alpina*	Population trend	Long term population trend stable or increasing	The site supports nationally important numbers of this species.
		Distribution	No significant decrease in the range, timing or intensity of use of areas by Dunlin, other than that occurring from natural patterns of variation	
To maintain the favourable conservation condition of Black-tailed Godwit in Clonakilty Bay SPA, which is defined by the following list of attributes and targets:				
A156	Black-tailed Godwit *Limosa limosa*	Population trend	Long term population trend stable or increasing	The site supports internationally important numbers of this species.
		Distribution	No significant decrease in the range, timing or intensity of use of areas by Black-tailed Godwit, other than that occurring from natural patterns of variation	
To maintain the favourable conservation condition of Curlew in Clonakilty Bay SPA, which is defined by the following list of attributes and targets:				
A160	Curlew *Numenius arquata*	Population trend	Long term population trend stable or increasing	The site supports nationally important numbers of this species.
		Distribution	No significant decrease in the range, timing or intensity of use of areas by Curlew, other than that occurring from natural patterns of variation	
To maintain the favourable conservation condition of the wetland habitat in Clonakilty Bay SPA as a resource for the regularly occurring migratory waterbirds that utilise it. This is defined by the following attribute and target:				
A999	Wetlands	Habitat area	The permanent area occupied by the wetland habitat should be stable and not significantly less than the area of 508 hectares, other than that occurring from natural patterns of variation	The wetland habitat area was estimated as 508ha using OSi data and relevant orthophotographs

The site also supports a range of other bird species in significant numbers, including Mute Swan *Cygnus olor*, Wigeon *Anas penelope*, Teal *Anas crecca*, Oystercatcher *Haematopus ostralegus*, Ringed Plover *Charadrius hiaticula*, Golden Plover *Pluvialis apricaria*, Grey Plover *Pluvialis squatarola*, Lapwing *Vanellus vanellus*, Knot *Calidris canuta*, Bar-tailed Godwit *Limosa lapponica* and Redshank *Tringa totanus*. The site is also used by Mallard *Anas platyrhynchos*, Turnstone *Arenaria interpres*, Red-breasted Merganser *Mergus serrator*, Cormorant *Phalacrocorax carbo* and increasingly in small numbers, Little Egret *Egretta garzetta* (NPWS, 2014c).

Grey Heron *Ardea cinerea* also commonly use the site and a heronry is located in the trees near Clonakilty. Cloheen Strand Inlet is also a regular wintering site for a small number of Short-eared Owl *Asio flammeus* (NPWS, 2014c).

The site is a regular staging post for scarce autumn migrants, especially Little Stint *Calidris minuta*, Curlew Sandpiper *Calidris ferruginea* and Spotted Redshank *Tringa erythropus* (NPWS, 2014c).

3.3.1.1 Conservation Objectives for the non-breeding Special Conservation Interests

The overarching Conservation Objective for Clonakilty Bay Special Protection Area is to ensure that waterbird populations and their wetland habitats are maintained at, or restored to, favourable conservation condition.

Objective 1: To maintain the favourable conservation condition of the non-breeding waterbird species by the following attributes and targets:

- To be favourable, the long term population trend for each waterbird Special Conservation Interest species should be stable or increasing. Waterbird populations are deemed to be unfavourable when they have declined by 25% or more, as assessed by the most recent population trend analysis.
- To be favourable, there should be no significant decrease in the range, timing or intensity of use of areas by the waterbird species of Special Conservation Interest, other than that occurring from natural patterns of variation.

Objective 2: To maintain the favourable conservation condition of the wetland habitat at Clonakilty Bay SPA as a resource for the regularly-occurring migratory waterbirds that ulitise it. This objective is defined by the following attributes and targets:

- To be favourable, the permanent area occupied by the wetland habitat should be stable and not significantly less than the area of 508 ha, other than that occurring from natural patterns of variation.

3.3.2 Site Vulnerability

NPWS (2015b) identifies that part of Clonakilty Bay has been threatened by landfill in the recent past and this remains a general threat. Some pollution is also likely to be entering the bay from Clonakilty Town and the surrounding agricultural lands, although this is unlikely to affect the wintering bird populations. An increase in the recreational use of the beaches could cause disturbance to the birds (NPWS, 2015b).

3.4 Description of the Receiving Environment

The ecological desk-based assessment and survey data collected during production of this NIS, and also the EIA process, is summarised below.

3.4.1 Habitats

The habitats recorded along the surveyed stretches of river are shown in Figure 3-2 below, followed by short descriptions of the key habitat types found around, or in connection with, the designated sites.

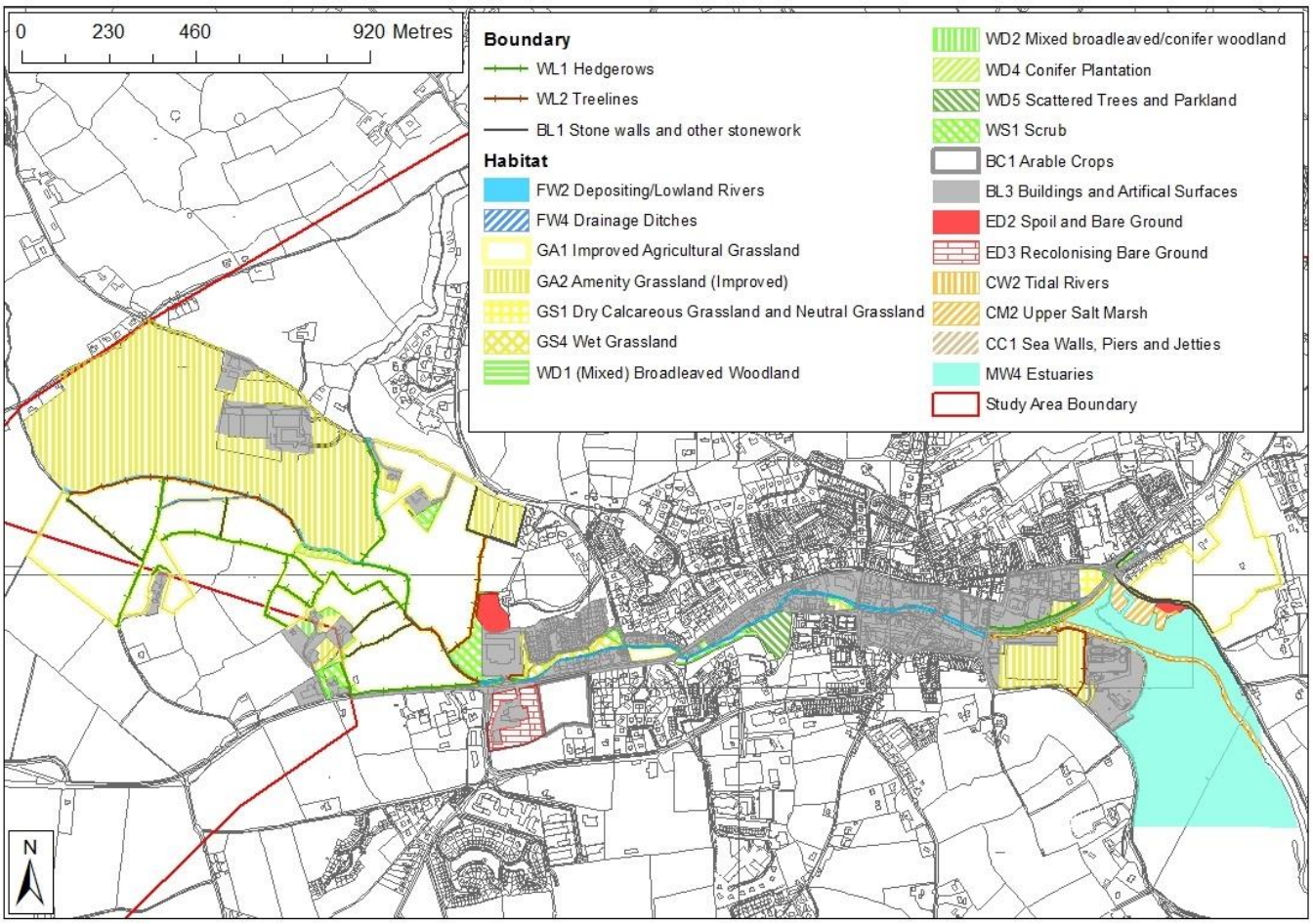

Figure 3-2: Fossitt Habitat Classification

Estuarine and intertidal habitats

The downstream reaches of the River Fealge are tidal (CW2). The Fealge discharges into the south-west of Clonakilty Bay alongside The Croppy Road, with a second smaller watercourse joining in the north-east at Facksbridge.

The Croppy Road is situated on an embankment at the head of the estuary and forms the initial defence to the town of Clonakilty. This embankment is also an amenity feature with small ornamental tree planting and park benches (BC4, WS3). The uppermost parts of this embankment are dominated by Perennial Rye-grass *Lolium perenne*, with common ruderal species including Ribwort Plantain *Plantago lanceolata*, Yarrow *Achillea millefolium*, Cock's-foot *Dactylis glomerata* and ornamental planting. Moving down the slope of the embankment the influence of the tidal environment is more evident, with species including Alexanders *Smyrnium olusatrum*, Sea Beet *Beta vulgaris* and Red Fescue *Festuca rubra* present. The species present on the lower embankment are more characteristic of upper salt marsh vegetation (CM2), but it is limited in extent and of poor quality due to the modified nature of the substrate and high levels of disturbance.

Figure 3-3: Estuarine habitats adjacent to The Croppy Road with the change in embankment vegetation shown on the left

There are also areas of upper salt marsh/maritime grassland along the north-eastern boundary of the Clonakilty Bay, formed behind stone walls which have created tidal inlets (e.g. at Deasy's Quay).

At the time the survey was conducted the tide was high, but at low tide extensive areas of mudflat habitat would be exposed within the estuary (MW4, LS2, LS3).

River Fealge

Through the town of Clonakilty, the river becomes wider, but constrained on both banks by walls and development (BL1, BL3). A number of bridges cross the river and some sections run through culverts beneath buildings. In-channel vegetation is very limited in these areas, although the walls alongside the river contain a number of species including Ivy, Polypody *Polypodium vulgare*, Broad-leaved Dock and a number of mosses and liverworts.

Figure 3-4: The River Fealge in the town of Clonakilty at the Casement Street Bridge (left) and the Seymour Street footbridge (right)

The upstream part of the River Fealge is a faster-flowing watercourse with a gravel/silt substrate (FW1). It is tree-lined (WL2) on the right bank, with in-channel vegetation consisting predominantly of Hemlock Water-dropwort *Oenanthe crocata* and River Water-crowfoot *Ranunculus fluitans*, and very occasional Water-starwort *Callitriche* sp.

The Urban Environment

The town of Clonakilty dominates much of the downstream part of the surveyed area with developments and walls lining the River Fealge. Within the town itself a number of smaller grassland areas are present, predominantly of amenity type (GA2) and often with occasional ornamental tree and shrub planting (BC4, WS3).

Other recorded habitats

Other habitats recorded during the ecological surveys including improved agricultural grassland (GA1) and atypical amenity grassland (improved) (GA2) which dominate the fluvial storage area, hedgerows (WL1), a range of broadleaved and mixed woodland types (WD1, WD2), conifer

woodland (WD4) and scrub (WS1). These habitat types are not discussed in detail in this NIS as they are located a considerable distance upstream of the designated site.

3.4.2 Birds

A considerable amount of data regarding bird populations within the study area was collected as part of the desk-based assessment, including from the National Biodiversity Data Centre and the NPWS Waterbird Survey Programme 2010/11 (Cummins and Crowe, 2011). A review of this data identified that the study area supports a number of notable species, in particular wetland birds in association with Clonakilty Bay.

3.4.3 *Waterbirds within Clonakilty Bay*

Results from the 2010/2011 Waterbird Survey Programme as undertaken by the NPWS (Cummins and Crowe, 2011) recorded a total of 43 waterbirds at Clonakilty Bay in the winter of 2010/11. This study highlighted that Black-tailed Godwit were recorded with a peak count of 761 which is of international importance. This species occurred at 15 of the 17 surveyed subsites within the Bay, with numbers peaking in November. Furthermore, the surveys showed that Shoveler (35), Knot (793), Dunlin (1,081) and Greenshank (22) were recorded in numbers of national importance. Of note, the peak count of Curlew within Clonakilty Bay (545) falls only slightly short of the threshold number for national importance at 550 individuals. In addition, the most inland areas within the Bay are important for Lapwing and Bar-tailed Godwit with highest numbers being recorded at this location.

A study of waders at Clonakilty Bay suggested that over-wintering species exhibited site fidelity over the six winter seasons that the study spanned (Lewis and Kelly, 2012). Furthermore, the study confirms a Bar-tailed Godwit and Black-tailed Godwit roosting site alongside the river channel within the inner estuary, near the sewage works and in close proximity to proposed works areas. This study highlighted the importance of the inner estuary for a range of foraging wading bird species. In addition to the shelter provided by this area, birds are possibly benefiting from organic enrichment that is sustaining relatively high numbers of macro-invertebrates, with the enrichment attributed to the Clonakilty Waste Water Treatment Plant (WWTP) which discharges effluent into the head of the estuary (Lewis and Kelly, 2012).

3.4.4 Otter

During the ecological walkover survey, evidence of Otter was recorded at two locations along the River Fealge, including a resting place within a large pile of rocks located immediately upstream of where the Capeen Stream.

3.4.5 Bats

The bat survey work identified that bats are fairly ubiquitous within the study area, and at a number of key locations within the town the numbers of foraging animals were very high. A number of trees and walls alongside the River Fealge, Ballyhalwick Stream and Garage Stream were also identified as having potential as roost sites.

3.4.6 Fisheries

The assessment and survey work on the River Fealge identified that parts of the river provide good to excellent fish habitat, however, many areas of gravel contained sand or silt which would limit the effectiveness of the substrate as spawning habitat. Spawning habitat availability in the lower reaches of the Fealge is limited, with low velocities due to tidal influence and the presence of weirs.

The electro-fishing survey identified the presence of Brown Trout *Salmo trutta* (n=275), European Eel *Anguilla anguilla* (n=38), Salmon *Salmo salar* (n=3), Stone Loach *Barbatula barbatula* (n=5) and Three-spined Stickleback *Gasterosteus aculeatus* (n=5). The age of the fish encountered indicated that the sample sites provides excellent nursery and rearing habitat for salmonids and taken as a whole the River Fealge was considered a very productive river for salmonids, with large numbers of juvenile Brown Trout present.

The additional fisheries impact assessment concluded that the River Fealge and its tributaries generally provides good spawning and nursery habitat for salmonids. Good holding habitat for adult salmonids was mainly recorded in the River Fealge. Lamprey habitat was recorded on the Ballyhalwick Stream, River Fealge and Garage Stream. The River Fealge, Garage Stream and Convent Stream could also potentially support European eel.

3.4.7 Non-native Invasive Species

A small patch of Japanese Knotweed *Fallopia japonica* was recorded during the ecological walkover survey, in a small area of amenity grassland and ornamental planting to the south of the N71/Convent Road, north-east of the Facksbridge Roundabout where wall construction/repair is proposed. No evidence of other invasive non-native species was recorded during the survey, with the exception of occasional ornamental Rhododendron *Rhododendron ponticum* in the grounds of the church.

An additional invasive species survey was conducted on May 20th and 21st 2016, during which Japanese Knotweed was also recorded at locations along the Ring Road, Croppy Road (N71) adjacent to the estuary and the Waterfront development, and on the northern ditch of the The Miles and Clogheen Cottages road junction. No works are proposed at the latter location.

4 Appropriate Assessment

4.1 Introduction

The following chapter assesses the impacts of the River Fealge (Clonakilty) Drainage Scheme in relation to the Natura 2000 Sites of Clonakilty Bay SAC and SPA.

4.2 Summary of Screening Results

The Appropriate Assessment Screening Report (JBA Consulting, 2014) identified that, in relation to Clonakilty Bay SAC, a number of qualifying interests could be screened out in relation to flood storage and tidal/fluvial defence measures which are part of the preferred option. These include:

- Annual vegetation of drift lines [1210]
- Embryonic shifting dunes [2110]
- Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes) [2120]
- Fixed coastal dunes with herbaceous vegetation (grey dunes) [2130]
- Atlantic decalcified fixed dunes (*Calluno-Ulicetea*) [2150]

As the ecological walkover survey did not identify any dune or drift line habitats in the area around the head of the estuary where works are proposed, no direct impact on these habitat types can occur. Furthermore, given the size of the estuary and the influence of dilution effects, and the localised nature of the works, potential indirect sources of impact, such as pollution, sediment mobilisation or changes to hydrological or sediment regimes (see Appendix B), are not considered to have a widespread impact across the estuary which could impact upon the dune and drift line habitats identified by NPWS (2014b) as being located on Inchydoney Island, approximately 3km to the south of the proposed works. Consequently, no pathway is likely to exist for these habitats to be adversely effected by the construction or operation of the flood relief scheme. As a result, the only qualifying interest of Clonakilty Bay SAC that remains screened into this NIS is mudflats and sandflats not covered by seawater at low tide [1140].

For Clonakilty Bay SPA all special conservation interests were screened into the assessment and are therefore considered in this NIS.

4.3 Identification of Potential Sources of Impact

This section further examines the potential sources of impact that could potentially result in adverse effects arising on the two screened in Natura 2000 sites (i.e. Clonakilty Bay SAC and SPA). These potential sources of impact could arise during both the construction and operational phases, but require complete source > pathway > receptor changes for adverse impacts to arise.

4.3.1 Physical Damage

Physical damage includes degradation to, and modification of, habitats within the designated boundaries of a Natura 2000 site. It can occur in working areas and along access routes where construction works are undertaken, and it may be temporary or permanent.

The construction of the defences around the head of the estuary could potentially result in direct physical damage to designated habitats should works encroach within the boundaries. As no permanent works will be constructed within the boundaries of the SAC and SPA there will be no habitat loss, but the footprint of the construction works, which will be greater than the finished footprint of the defences, may encroach into the SAC and SPA and result in physical damage.

4.3.2 Changes in physical regime

This source of impact may result in changes to physical processes that can alter the present characteristics of the Natura 2000 site (e.g. estuarine, fluvial and geomorphological processes, salinity levels, tidal regimes, erosion, deposition, sediment transport and accumulation). This could then result in degradation or loss of habitats indirectly, either temporarily or permanently.

4.3.3 Changes in hydrological regime

Certain activities may result in changes to the current hydrological regime. For example, a reduction or increase in the frequency, extent, duration and/or depth of flooding may affect estuarine, riverine and floodplain habitats. Activities which may affect surface and groundwater

levels, such as impoundments or defence construction, may also have adverse impacts on water dependant habitats and species.

4.3.4 Disturbance (noise, visual)

A number of activities can result in disturbance, including visual and noise. This is more frequently associated with construction activities, but could also be associated with some aspects of the operational phase (e.g. structure maintenance). Disturbance can cause sensitive species, such as birds, to deviate from their normal, preferred behaviour, resulting in stress, increased energy expenditure and, in some cases, species mortality.

4.3.5 Changes in water quality

A number of activities can impact upon water quality, in particular nutrient status and turbidity levels. For example, inundation of contaminated/nutrient enriched land and sediment mobilisation can all impact on water quality. This can adversely impact on habitats and also species, for example by impacting upon macro-invertebrate communities.

4.3.6 Pollution

Certain activities, in particular construction works, may lead to the release of pollutants, into water, air or the ground. This can impact upon habitats directly and also the species they support.

4.4 Impact Assessment

Table 4-1 assesses each of the screened in Natura 2000 sites in more detail and examines where potentially adverse impacts may arise from the sources of impact identified above. Where potentially significant adverse impacts are identified, avoidance and mitigation measures are proposed to offset these impacts. Further information on the avoidance and mitigation measures is provided in section 4.6.

4.5 In-combination Effects

Appropriate Assessment requires consideration of the impacts of a scheme, in-combination with other plans or projects. Potential sources of in-combination effects identified as part of this assessment include:

- Under the 1945 Arterial Drainage Act the OPW have a statutory requirement to undertake channel and embankment maintenance operations within a scheme and this will apply to the River Fealge (Clonakilty) Drainage Scheme. Channel and embankment maintenance operations can encompass a variety of activities, including silt and vegetation management, aquatic vegetation cutting, bank protection, bush cutting/branch trimming, tree cutting, mulching, mowing and structure maintenance (Ryan Hanley, 2014). The exact nature and scale of channel and embankment maintenance work likely to be required for the River Fealge (Clonakilty) Drainage Scheme is currently unknown. However, all OPW maintenance work is undertaken in accordance with Environmental Management Protocols and Standard Operating Procedures (OPW, 2011) to ensure adverse impacts on the environment are considered and minimised. OPW drainage maintenance activities are also be subject to a separate Appropriate Assessment process to ensure no adverse impacts arise. Consequently, adverse in-combination effects on Clonakilty Bay SAC and SPA from the delivery of this flood relief scheme and its ongoing maintenance are not anticipated.
- The River Fealge (Clonakilty) Drainage Scheme River Fealge (Clonakilty) Drainage Scheme involves the installation of two below ground pumping stations to allow rainwater that falls behind the defences to be pumped out back in the River Fealge and Clonakilty Bay. The flood relief scheme will involve construction of pumping stations at Rossa Street and Kent Street, which are located outside of the designated site boundaries and which will pump water into the River Fealge and will therefore not impact on the designated site alone or in-combination. However, two further underground pumping stations will be constructed by Cork County Council at Croppy Road and the old GAA grounds; both of these will discharge into the Bay and could therefore result in adverse in-combination effects on the estuary during both the construction phase and operational phase. This is discussed where relevant in Table 4-1 below.

- Within the South Western River Basin Management Plan (RBMP), the Action Plan for the Skibbereen Clonakilty Water Management Unit (WMU) identifies that watercourse SW_20_2260 Clonakilty Stream (i.e. the River Fealge) is of moderate standard (i.e. Q score 3-4), with a key pressure being the WWTP. The WMU action plan therefore identifies that Clonakilty WWTP requires capital works and implementation of an Appropriate Performance Management System to help improve the condition of the watercourse. Work is currently ongoing at the WWTP to upgrade the site in order to meet the needs of Clonakilty and should be complete in spring/summer 2015; this has been undertaken as part of the Water Services Investment Programme. It is therefore highly unlikely that the construction periods of the WWTP upgrade and River Fealge (Clonakilty) Drainage SchemeRiver Fealge (Clonakilty) Drainage Scheme will overlap and therefore there will be no cumulative construction impacts.
- A search of Cork County Council's online planning enquiry database was undertaken to identify other projects in and around the Clonakilty Bay SAC and SPA, which are proposed or have been constructed over the last two years, to determine if there was any potential for in-combination effects. The vast majority of these developments are small-scale, associated with residential dwellings and involve alteration or extension to existing structures. From these small-scale localised developments, no in-combination effects are anticipated.

4.5.1 Tidal barrage

A Tidal Barrage is proposed in the development plan (draft) and if it goes ahead, it will be assessed under the Habitats Directive. However, it is envisaged that the proposed scheme will reduce the potential requirement for a Tidal Barrage as a flood management structure. The potential cumulative impacts of the proposed flood alleviation scheme in combination with a Tidal Barrage would not be significant, as a result of the flood alleviation measures chosen as these aim to avoid permanent works within the estuary and Clonakilty Bay SAC and SPA. However, the Tidal Barrage as a project in its own right may have significant impacts on Clonakilty Bay SAC and SPA and therefore is not viewed as the most appropriate option in the Options Appraisal Report due to the potential significant permanent impacts on Clonakilty Bay SAC and SPA, for this reason the development of the Tidal Barrage is unlikely to proceed due to adverse impacts on Clonakilty Bay SAC and SPA. However, should it proceed the current flood scheme will not contribute to the adverse impacts of the Tidal Barrage.

Table 4-1: Impact Prediction and Assessment

Site Name (Site Code)	Qualifying Interests/ Special Conservation Interests	Potential Source of Impact	Impact on Attribute and Target and Prior to Mitigation / Avoidance from River Fealge (Clonakilty) Drainage Scheme	Potential in-combination effects	Avoidance / Mitigation Measures	Residual Impact
Clonakilty Bay SAC (000091)	Mudflats and sandflats not covered by seawater at low tide [1140]	Physical damage	During the construction phase of the tidal walls and embankments along the Ring Road, The Croppy Road between Clarke Street and Facksbridge and from Clarke Street along the south bank, through the Waterfront Development to boundary of the WWTP, a cofferdam will likely be installed to allow for construction. Upon completion no part of the permanent tidal defence walls will encroach within the boundaries of the SAC, but during the construction phase there will be a temporary loss of, and physical damage to, mudflat and sandflat habitats within the footprint of the walls and wider working area, in particular along the alignment of the cofferdam. Mudflat and sandflat sediment, and the invertebrate community they support, will be disturbed and excavated to facilitate construction of the works. This may temporarily adversely impact upon habitat area and community distribution attributes of this habitat type. However, in the long-term there will be no loss of mudflat habitat and no impact upon the habitat area attribute. In relation to the second attribute relating to Sand to sandy mud substrate with a specific invertebrate community, proposed activities or operations that cause significant disturbance to communities, but that may not necessarily represent a continuous or ongoing source of disturbance over time	Potential in-combination physical damage effects associated the construction of the discharge points for the pumping stations on The Croppy Road and old GAA ground may occur. However, the discharge points will be extremely small and a significant in-combination impact is not anticipated.	Permanent works **will not** encroach within the boundaries of the SAC. The footprint of the construction works will be minimised (i.e. they will not extend more than 5m from toe of the existing embankment/wall) to limit encroachment into the site. Work on the discharge points for the pumping stations on The Croppy Road and old GAA ground will be conducted at the same time and within the same footprint as that for the tidal defences. Work will not encroach into previously unaffected areas of designated habitat.	No

Site Name (Site Code)	Qualifying Interests/ Special Conservation Interests	Potential Source of Impact	Impact on Attribute and Target and Prior to Mitigation / Avoidance from River Fealge (Clonakilty) Drainage Scheme	Potential in-combination effects	Avoidance / Mitigation Measures	Residual Impact
			and space may be assessed in a context-specific manner giving due consideration to the proposed nature and scale of activities and the particular resilience of the receiving habitat (NPWS, 2014e). This principle can be applied to the mudflat and sandflat habitats, and the invertebrate community they support, of Clonakilty Bay as the impact will not be continuous, mudflat habitats are resilient to change and upon completion of the works will recover as tidal processes re-mobilise and replace substrate in the affected area. The invertebrate community will then be able to re-colonise from adjoining, unaffected mudflat areas resulting in a short-term, reversible impact only.			
		Changes in physical regime	The tidal defences around the fringes of mudflat habitats within Clonakilty Bay (i.e. those along the Ring Road, The Croppy Road and those from Clarke Street Bridge along the south bank near the WWTP) could cause increased scour which would gradually result in damage to and erosion of mudflat habitats around these areas. However, hydraulic model analysis has shown that the impact on model velocities as a result of the scheme will be minimal across the flow regime (0.06m/s to 0.2m/s), and will remain within the depositional range. Furthermore, the defences will only influence hydraulics during extreme flows which are infrequent (see Appendix B,	None identified	None proposed as the effect of changes to the physical regime are not considered to be significant.	No

Site Name (Site Code)	Qualifying Interests/ Special Conservation Interests	Potential Source of Impact	Impact on Attribute and Target and Prior to Mitigation / Avoidance from River Fealge (Clonakilty) Drainage Scheme	Potential in-combination effects	Avoidance / Mitigation Measures	Residual Impact
			section B.5, rows R1 on Fig. 2-2, L35 on Fig. 2-2 and L36 on Fig. 2-2). In addition, during the construction phase minor increases in velocities would be expected due to the use of the cofferdam, but again these remain within the depositional range and are considered to have a negligible impact and will not impact upon the ecological functioning of the mudflat habitats within the head of Clonakilty Bay SAC as a whole. As a result the potential impact of changes to the physical regime are not considered significant.			
		Changes in hydrological regime	The flood walls proposed for a number of locations (i.e. The Croppy Road, from Clarke Street Bridge to the Waterfront Development, between Seymour Street Pedestrian Bridge and Clarke's Street Bridge, between the library and Rossa Street Bridge, between Rossa Street Bridge and Seymour Street Pedestrian Bridge and between Michael Collins Bridge and the library) could heighten in-channel energy conditions during flood conditions, potentially mobilising some of the coarse gravel substrate within the River Fealge, preventing deposition. This gravel material may then be transported into the SAC whereas previously it would have been deposited within the channel of the Fealge. This indirect impact on geomorphological processes within the river and the effect on sediment supply to the mudflats at the head of the estuary could potentially impact upon the quality	The construction of the discharge points through the new flood wall for the pumping stations on The Croppy Road and old GAA ground will introduce surface water into Clonakilty Bay at two specific points, whereas currently this water reaches the bay via distributed surface water run-off. This could result in in-combination effects, however, these are not considered to be significant as the same volume of water as that which currently	None proposed as the effect of changes to the hydrological regime are not considered to be significant.	No

Site Name (Site Code)	Qualifying Interests/ Special Conservation Interests	Potential Source of Impact	Impact on Attribute and Target and Prior to Mitigation / Avoidance from River Fealge (Clonakilty) Drainage Scheme	Potential in-combination effects	Avoidance / Mitigation Measures	Residual Impact
			and extent of the mudflats within the SAC. However, the hydromorphological audit (Appendix B, section B.3) conducted as part of the EIA process identified that significant quantities of gravel were not being transported through the system, with strong evidence of gravel deposition within the river in dynamically stable features and therefore the volumes of coarser sediment that may be deposited within the mudflat habitats is considered to be very low and in localised areas only. Furthermore, hydraulic model analysis has shown that upon completion the works will result in only minor increases in maximum channel velocities across the flow regime (up to 0.02m/s), and consequently the risk of any significant changes to patterns of erosion and deposition are low (see Appendix B, section B.5, row L32-34 on Fig 2-2). The potential impacts of changes to the hydrological regime are not considered significant.	reaches the bay will still enter the bay, although via the pumping station rather than surface water run-off. Consequently, no adverse in-combination impacts on the hydrological regime are anticipated.		
		Changes in water quality / pollution	During the construction phase there is the potential that silt within watercourses will be mobilised or that pollution incidents could occur. The River Fealge could then act as a pathway for this contaminated material to reach the designated Clonakilty Bay, adversely impacting upon the habitats and species present. Contaminated water or silt may locally adversely affect the habitats, flora and macro-invertebrate fauna they support at	Potential in-combination water quality/pollution effects associated with the construction of the discharge points for the pumping stations on The Croppy Road and old GAA ground may occur.	Appropriate pollution prevention measures will be followed (see section 4.6.2). These measures will also need to be followed for construction of the pumping stations on The Croppy Road and old GAA ground.	No

Site Name (Site Code)	Qualifying Interests/ Special Conservation Interests	Potential Source of Impact	Impact on Attribute and Target and Prior to Mitigation / Avoidance from River Fealge (Clonakilty) Drainage Scheme	Potential in-combination effects	Avoidance / Mitigation Measures	Residual Impact
			the head of the estuary, including mudflats and sandflats. This could then impact upon the food source of the waterbird populations in this area, causing them to have to find alternative feeding areas. However, given the large size of the estuary, the resulting dilution effects, and the relatively localised nature of the works, a large proportion of which are upstream of the site, this is unlikely to have a widespread impact across the bay.			
Clonakilty Bay SPA (004081)	Shelduck *Tadorna tadorna* [A048] Dunlin *Calidris alpina* [A149] Black-tailed Godwit *Limosa limosa* [A156] Curlew *Numenius arquata* [A160]	Disturbance (noise, visual)	Construction works along the boundaries of the SPA would generate disturbance as a result of machinery operation and workforce movement; this will impact upon the waterbird populations within the SPA, in particular Shelduck, Dunlin, Black-tailed Godwit and Curlew for which the site is designated. Lewis and Kelly (2012) identify that the inner estuary area, in closest proximity to the works site, are important for Dunlin, Black-tailed Godwit and Curlew, however, little information is available for Shelduck and it is therefore assumed to be present in the inner estuary also. Whilst the Croppy Road already provides some background levels of disturbance as a result of vehicular and pedestrian movements, construction activities are likely to be more disruptive in terms of noise level and frequency of movement. A number of studies have identified differential disturbance responses of bird species,	Potential in-combination disturbance impacts associated the construction of the discharge points for the pumping stations on The Croppy Road and old GAA ground may occur impacting up on the special conservation interests of the SPA.	The construction of the flood wall along the Ring Road and all cofferdam installation and removal works to the flood walls along The Croppy Road between Clarke Street and Facksbridge, and from Clarke Street along the south bank, through the waterfront development and WWTP will be conducted between March and September inclusive. Should works extend through the winter period (i.e. October - February) the following measures should be undertaken, although they may be adopted as best practice:	No

Site Name (Site Code)	Qualifying Interests/ Special Conservation Interests	Potential Source of Impact	Impact on Attribute and Target and Prior to Mitigation / Avoidance from River Fealge (Clonakilty) Drainage Scheme	Potential in-combination effects	Avoidance / Mitigation Measures	Residual Impact
			linked to the type of disturbance stimuli, the bird community present and their activity, the extent and topography of the site, the time of year and weather conditions (Cutts and Allen, 1999). For example, Cutts and Allen (1999), in relation to flood defence works at Saltend on the Humber Estuary, have observed that Shelduck are susceptible to disturbance associated with construction activities, with a shift in location from preferred feeding areas within 250m of the works site in upper estuary areas. Similarly, Curlew reaction to disturbance events would suggest that a minimum feeding range is 150m from the works, although with a degree of habituation this may reduce to 100m (Cutts and Allen, 1999). Dunlin response to construction activity is variable, with minimum distances to disturbance of between 100-200m observed, although this varied cyclically from as low a 50m up to 500m (Cutts and Allen, 1999). Limited information is available for Black-tailed Godwit. The increased level of disturbance associated with the River Fealge (Clonakilty) Drainage Scheme construction works can therefore be considered to result in disturbance, which will cause displacement of bird populations from the head of the estuary as activities will be conducted within the tolerance distances outlined above. This will result in increased stress and		a) Daily monitoring of average daytime temperatures will be undertaken. When average daytime temperatures fall below 0ºC for five consecutive days, works will temporarily cease. Works can proceed again when temperatures become milder. b) The cofferdam will be designed in order to provide visual and noise screening to birds using the head of the estuary. On the landward side further screening will be erected to hide the movement of machinery and the workforce. No machinery or workforce will work beyond the cofferdam. c) Visual and noise screening to birds will be erected prior to the construction of the flood wall and embankment, and road level adjustment along the Ring Road. This screening will remain in place for the duration of the works.	

Site Name (Site Code)	Qualifying Interests/ Special Conservation Interests	Potential Source of Impact	Impact on Attribute and Target and Prior to Mitigation / Avoidance from River Fealge (Clonakilty) Drainage Scheme	Potential in-combination effects	Avoidance / Mitigation Measures	Residual Impact
			additional energy expenditure and at certain times of year (i.e. during cold spells in the winter) the effect of this could be particularly severe, potentially resulting in bird mortality.		d) Any temporary lighting installed for the construction phase will be fitted with a cowl to limit light spill and will be directed away from the estuary. e) All machinery used along the Ring Road, Croppy Road between Clarke Street and Facksbridge, and from Clarke Street along the south bank, through the waterfront development and WWTP will be fitted with noise reduction measures. The discharge points for the pumping stations on The Croppy Road and old GAA ground will be constructed between March and October inclusive.	
	Shelduck *Tadorna tadorna* [A048] Dunlin *Calidris alpina* [A149] Black-tailed Godwit *Limosa limosa* [A156] Curlew *Numenius arquata* [A160]	Physical damage Changes in physical regime Changes in hydrological regime Changes in water quality / pollution	The bird species for which the SPA is designated are reliant upon mudflat and sand flat habitats at the head of the estuary for roosting and feeding. The assessment provided above in relation to the mudflat and sandflat habitats of Clonakilty Bay SAC therefore also applies in relation to the SPA as the bird species supported by the mudflat and sandflat habitats will similarly be impacted upon through a temporary loss of and reduced	Same assessment as for Clonakilty Bay SAC applies.	Same mitigation as for Clonakilty Bay SAC applies.	No

Site Name (Site Code)	Qualifying Interests/ Special Conservation Interests	Potential Source of Impact	Impact on Attribute and Target and Prior to Mitigation / Avoidance from River Fealge (Clonakilty) Drainage Scheme	Potential in-combination effects	Avoidance / Mitigation Measures	Residual Impact
	Wetland & Waterbirds [A999]		quality these habitats for roosting and feeding.			

4.6 Avoidance and Mitigation Measures

This section describes the avoidance and mitigation measures to prevent or reduce impacts on Clonakilty Bay SAC and SPA that will be incorporated into the proposed River Fealge (Clonakilty) Drainage Scheme.

All of the works and mitigation measures will be monitored by a suitably qualified ecologist during the construction period, with findings reported to the competent authority.

4.6.1 Measures to avoid/mitigate impacts of physical damage

In order to mitigate identified construction and operational impacts on the Clonakilty Bay SAC and SPA from physical damage the following mitigation measures will be implemented:

- The permanent works (i.e. the tidal defence walls and embankments) **will not** encroach into Clonakilty Bay SAC, SPA and pNHA.
- The footprint of the construction works on the tidal defences, including any cofferdam installation, will be minimised (i.e. they will not extend more than 5m from toe of the existing embankment/wall) to limit encroachment into Clonakilty Bay SAC and SPA. When working at the river channel outlet to the bay the works area will not extend beyond 5m from the designation boundary into the designation area.
- Work on the discharge points for the pumping stations on The Croppy Road and old GAA ground will be conducted at the same time and within the same footprint as that for the tidal defences. Work will not encroach into previously unaffected areas of designated habitat.

4.6.2 Measures to avoid/mitigate pollution and water quality issues

Appropriate mitigation measures will be implemented prior to the construction phase to ensure that water quality of the River Fealge and Clonakilty Bay is not adversely affected through pollution incidents and silt mobilisation. This mitigation will include:

- Relevant Pollution Prevention Guidelines (PPG) produced jointly by the Environment Agency, Scottish Environment Protection Agency (SEPA) and the Environment and Heritage Service of Northern Ireland will be followed, along with SEPA (2009 *Engineering in the Water Environment Good Practice Guide - Temporary Construction Methods*.
- Appropriate sediment control measures will be employed.
- Any chemical, fuel and oil stores will be located on an impervious base within a secured bund with a storage capacity 110% of the stored volume.
- Biodegradable oils and fuels will be used where possible.
- Drip trays will be placed underneath any standing machinery to prevent pollution by oil/fuel leaks. Where practicable, refuelling of vehicles and machinery will be carried out on an impermeable surface in one designated area well away from any watercourse or drainage (at least 10m).
- Emergency spill kits will be available on site and staff trained in their use.
- Operators will check their vehicles on a daily basis before starting work to confirm the absence of leakages. Any leakages should be reported immediately.
- Daily checks will be carried out and records kept on a weekly basis and any items that have been repaired/replaced/rejected noted and recorded. Any items of plant machinery found to be defective will be removed from site immediately or positioned in a place of safety until such time that it can be removed. All items of plant will be checked prior to use before each shift for signs of wear/damage.
- All washing out of grout pumps will be carried out in designated areas away from the river, such as in the lined compound area. At no point will grout pumps be washed out at the worksite.
- All cofferdams, or other structure installed within the channel, to allow working in dry conditions must be designed by a competent person, be constructed of appropriate materials and take account of site conditions (i.e. depth of water, available space, bed substrate, flow velocities, flow patterns, duration of works, accessibility and potential ingress of water). During any working with cofferdams the following will be adhered to:

- The cofferdam will be inspected daily for any movement, leakage and general deterioration; any defects found will be remedied immediately.
- There will be no significant tracking by machinery of the river/ estuary bed.
- The working area will not be de-watered directly into the River Fealge or Clonakilty Bay; the removed water must receive treatment before discharge.
- Before removal of the cofferdam at completion of the works all materials, debris, tools, plant and equipment will be removed from the work area and any potential sources of pollution/contamination within the cofferdam will be cleaned up.
- The de-watered area will be re-watered before the cofferdam is removed to avoid the sudden ingress of water which may cause erosion of the replaced substrate.
- When re-watering is undertaken, the pump inlets will be screened appropriately to prevent the intake of fish or other aquatic animals.

- During all works the weather forecast will be monitored and a contingency plan developed to prevent damage or pollution during extreme weather and high flow events.
- The above measures will also need to be followed during construction of the pumping stations on The Croppy Road and old GAA ground.

4.6.3 Measures to avoid/mitigate disturbance impacts

In order to prevent disturbance impacts to important overwintering bird populations within Clonakilty Bay SPA the following mitigation will be implemented:

- All cofferdam installation and removal works along Croppy Road between Clarke Street and Facksbridge, and from Clarke Street along the south bank, through the waterfront development and WWTP will be conducted between April and September inclusive.
- The discharge points for the pumping stations on The Croppy Road and old GAA ground will be constructed between April and September inclusive.
- No harbour-side works will be undertaken between the months of February and March, the critical period before migration.
- If it is necessary for works to extend through the winter period (i.e. October - February), the following measures will be taken;
  - Daily monitoring of average daytime temperatures will be undertaken. When average daytime temperatures fall below 0ºC for five consecutive days, works will temporarily cease. Works can proceed again when temperatures become milder.
  - The cofferdam will be designed in order to provide visual and noise screening to birds using the head of the estuary and on the landward side further screening will be erected to hide the movement of machinery and the workforce. No machinery or workforce member will work beyond the cofferdam.
  - Visual and noise screening to birds will be erected prior to the construction of the flood wall and embankment, and road level adjustment works along the Ring Road. This screening will remain in place for the duration of the works.
  - Any temporary lighting installed for the construction phase will be fitted with a cowl to limit light spill and will be directed away from the estuary.
  - All machinery used along the Ring Road, Croppy Road between Clarke Street and Facksbridge, and from Clarke Street along the south bank, through to the Waterfront development and WWTP will be fitted with noise reduction measures.

4.6.4 Measures to prevent the spread of non-native invasive species

In order to mitigate the possible spread of non-native invasive species, the following mitigation measures will be incorporated in to a site specific Invasive Species Management Plan:

- All works shall be conducted according to the NRA Guidelines 'The Management of Noxious Weeds and Non-Native Invasive Plant Species on National Roads'.
- Avoid working in areas where Japanese Knotweed is present; all areas within 7m of visible above-ground growth will be avoided, where possible and clearly demarcated.
- If work is required in areas infested with Japanese Knotweed (including any area within 7m of visible above-ground growth) an appropriate Japanese Knotweed Mitigation Strategy will need to be devised and implemented to prevent spread.

- Prior to commencement, all works areas, site compounds and access routes will be re-surveyed to ensure that stands of non-native invasive species have not become established. If found, appropriate mitigation strategies will need to be devised and implemented.
- An overall site specific Invasive Species Management Plan will be developed to address any areas that may affect the proposed scheme prior to the commencement of works. This will be required well in advance of the works in order to address both treatment and/or removal of Japanese Knotweed, in particular.
- All contractors and staff shall adhere to Biosecurity Protocols for invasive species.

5 Conclusions

This Natura Impact Statement details the findings of the Stage 2 Appropriate Assessment conducted to further examine the potential direct and indirect impacts of the proposed River Fealge (Clonakilty) Drainage Scheme on the following Natura 2000 sites:

- Clonakilty Bay SAC (000091)
- Clonakilty Bay SPA (004081)

The above sites were identified by a screening exercise that assessed likely significant effects of a range of flood risk management measures which were subsequently developed into a preferred option for the flood relief scheme. This preferred option principally involves construction of a fluvial storage area, behind a storage embankment, construction of tidal defences around Clonakilty Bay and repair/construction of defences elsewhere within the town.

The Appropriate Assessment investigated the potential direct and indirect impacts of the proposed works on the integrity and interest features of the above Natura 2000 sites, alone and in-combination with other plans and projects, taking into account the site's structure, function and conservation objectives.

Where potentially significant adverse impacts were identified, a range of mitigation and avoidance measures have been suggested to help offset them.

As a result of this Appropriate Assessment it has been concluded that, ensuring the avoidance and mitigation measures are implemented as proposed, the River Fealge (Clonakilty) Drainage Scheme will not have a significant adverse impact on the above Natura 2000 sites.

To confirm this conclusion, the following checklist, taken from DEHLG (2009) has been completed.

Table 5-1: Integrity of Site Checklist (from DEHLG, 2009)

Conservation objectives: does the project or plan have the potential to:	Y/N
Cause delays in progress towards achieving the conservation objectives of the sites?	N - Following mitigation, no significant adverse residual impacts have been identified that will prevent achievement of the conservation objectives of Clonakilty Bay SAC and SPA.
Interrupt progress towards achieving the conservation objectives of the sites?	N - Following mitigation, no significant adverse residual impacts have been identified that will prevent achievement of the conservation objectives of Clonakilty Bay SAC and SPA.
Disrupt those factors that help to maintain the favourable conditions of the site?	N - Potential adverse impacts identified during the screening process, including potential physical damage of habitats, changes to physical/hydrological regimes, water quality issues and pollution, can be avoided or mitigated against.
Interfere with the balance, distribution and density of key species that are the indicators of the favourable condition of the site?	N - Potential adverse impacts on the bird populations for which Clonakilty Bay SPA is designated can be avoided by appropriate timing of the cofferdam installation/ removal works and by implementing a range of measures to reduce and screen disturbance from construction works and protect estuarine and intertidal habitats supporting the bird populations.

Other objectives: does the project or plan have the potential to:	Y/N
Cause changes to the vital defining aspects (e.g. nutrient balance) that determine how the site functions as a habitat or ecosystem?	N - Potential adverse impacts from physical damage of habitats, sediment mobilisation and pollution, which could impact upon ecosystem functioning, can be effectively mitigated.
Change the dynamics of the relationships (between, for example, soil and water or plants and animals) that define the structure and/or function of the site?	N - Potential adverse impacts relating to changes in the physical and hydrological regime have been identified which could impact on the functioning and dynamics of the site; however these are not considered to be significant or impact upon the functioning of the SAC and SPA.
Interfere with predicted or expected natural changes to the site (such as water dynamics or chemical composition)?	N - Potential adverse impacts from changes to the physical and hydrological regime, have been identified which could impact on the functioning and dynamics of the site; however these are not considered to be significant or impact upon the functioning of the SAC and SPA.
Reduce the area of key habitats?	N - Potential adverse impacts on SAC mudflat and sandflat habitats can be effectively mitigated to ensure no permanent loss of habitat.
Reduce the population of key species?	N - Potential disturbance impacts to SPA bird populations can be effectively mitigated to ensure populations are not reduced, for example, through appropriate timing of the works.
Change the balance between key species?	N - Potential disturbance impacts to SPA bird populations can be effectively mitigated to ensure population dynamics are not adversely affected.
Reduce diversity of the site?	N - The identified mitigation measures to protect designated habitats and species will ensure that the current diversity of the sites is maintained.
Result in disturbance that could affect population size or density or the balance between key species?	N - Potential disturbance impacts to SPA bird populations can be effectively mitigated to ensure populations are not reduced.
Result in fragmentation	N - The proposed works will not result in the fragmentation of habitats within the SAC and SPA or surrounding habitat.
Result in loss or reduction of key features (e.g. tree cover, tidal exposure, annual flooding etc.)?	N - Potential adverse impacts on SAC habitats can be effectively mitigated to ensure no loss of or reduction of key features.

References

Cummins, S. and Crowe, O. (2011) Collection of baseline waterbird data for Irish coastal Special Protection Areas 2010/ 2011. Report commissioned by the National Parks and Wildlife Service.

Cutts, N. and Allen, J. (1999) Avifaunal disturbance assessment: Flood defence Work, Saltend. Institute of Estuarine and Coastal Studies, University of Hull, Hull.

Department of Environment, Heritage and Local Government (2009) Appropriate Assessment of Plans and Projects in Ireland - Guidance for Planning Authorities.

JBA Consulting (2014) Clonakilty Bay Flood Relief Scheme Appropriate Assessment Screening Report. Unpublished Report.

Lewis, L. J., & Kelly, T. C. (2012). Aspects of the spatial ecology of waders along an estuarine gradient. Irish Birds, 9, 375-384.

Mott MacDonald (2013a) SWRBD CFRAM Study: Appropriate Assessment Screening Report - Clonakilty. Office of Public Works.

National Biodiversity Data Centre (2014). *Live Maps*. [online] Available at: < http://maps.biodiversityireland.ie/#/Map> [Accessed: 13/02/2014].

NPWS (2011b) Conservation objectives for Clonakilty Bay SPA [004081]. Generic Version 4.0. Department of Arts, Heritage & the Gaeltacht.

NPWS (2013). Site Synopsis and Natura 2000 Data Form: Clonakilty Bay SAC. Site Code: 000091. Available online: http://www.npws.ie/protectedsites/specialareasofconservationsac/clonakiltybaysac/. Accessed: 03/01/2017.

NPWS (2014a) Conservation objectives for Clonakilty Bay SAC [000091]. Generic Version 3.0. Department of Arts, Heritage & the Gaeltacht.

NPWS (2014a). Protected Sites. Available online: http://www.npws.ie/protectedsites. Accessed: 03/01/2017

NPWS (2014b) Conservation Objectives Series: Clonakilty Bay SAC 000091. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.

NPWS (2014c). Site Synopsis: Clonakilty Bay SPA. Site Code: 004081. Available online: http://www.npws.ie/protectedsites/specialprotectionareasspa/clonakiltybayspa/. Accessed: 03/01/2017.

NPWS (2014e) Clonakilty Bay SAC 000091. Conservation Objectives supporting document - Marine Habitats. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.

NPWS (2015b). Natura 2000 Data Form: Clonakilty Bay SPA. Site Code: 004081. Available online: http://www.npws.ie/protectedsites/specialprotectionareasspa/clonakiltybayspa/. Accessed: 03/01/2017.

OPW (2011) Arterial Drainage Maintenance Service Environmental Management Protocols and Standard Operating Procedures. Unpublished Report

Ryan Hanley (2014) Office of Public Works Arterial Drainage Maintenance Environmental Services 2013. Stage 1: Appropriate Assessment Screening Methodology for the Maintenance of Arterial Drainage Schemes. Methodology. Unpublished Report.

Appendices

A Appendix A - Correspondence

An Roinn
Ealaíon, Oidhreachta agus Gaeltachta
Department of
Arts, Heritage and the Gaeltacht

Our Ref: **G Pre00131/2014**
Your Ref: **CG\2014s0971-I-L001-1.doc**

08 April 2014

Jonathan Cooper
24 Grove Island
Corbally
Limerick
jonathan.cooper@jbaconsulting.com

Re: **Clonakilty Flood Relief Scheme - Environmental Constraints Consultation**

A Chara,

On behalf of the Department of Arts, Heritage and the Gaeltacht, I refer to your correspondence in relation to the above. Outlined below are the observations of the Department in relation to nature conservation.

All aspects of this plan need to comply with the legislation relating to the Special Protection Area and Special Area of Conservation designations for the Clonakilty Bay area. The Department acknowledges that discussions with the consultants and National Parks and Wildlife Service for this project are on-going with a view to establish how this compliance can be achieved.

The acknowledgement to this letter or any further information should ideally be sent to manager.dau@ahg.gov.ie; if this is not possible, correspondence may alternatively be sent to:

The Manager
Development Applications Unit
Department of Arts, Heritage and the Gaeltacht
Newtown Road
Wexford

Finally, the above observations and recommendations are based on the papers submitted to this Department on a pre-planning basis and are made without prejudice to any observations the Minister may make in the context of any consultation arising on foot of any development application referred to the Minister, by the planning authority, in his role as statutory consultee under the Planning and Development Act 2000, as amended.

Is mise, le meas

Patricia O'Leary

Patricia O'Leary
Development Applications Unit
Tel: (053) 911 7482
e manager.dau@ahg.gov.ie

B Appendix B - Hydromorphology

B.1 Introduction

This section provides an overview of the existing hydromorphological condition of the associated project watercourses along with the impacts associated with the construction of the proposed flood mitigation scheme.

Hydromorphology can be described as the hydraulic interaction between channel form and channel flows to define physical habitat. This also demonstrates the important link between hydromorphological forms and processes, and ecological condition and habitat. A hydromorphological response to a physical modification within a watercourse needs to be understood to determine not only the impacts on hydromorphological condition but also the impacts to habitats at a local scale. Please refer to section 9 for information regarding the impacts to physical habitat and species.

The EU Water Framework Directive (WFD) is a key piece of European water legislation that is designed to improve and integrate the way water bodies are managed throughout Europe. Hydromorphology is a key aspect of the EU Water Framework Directive.

The WFD defines the flow, shape and physical characteristics of a watercourse as its 'hydromorphology.' Any in-channel works can impact upon the shape of a watercourse and the natural processes that occur within it, including:

- flow patterns
- width and depth of a channel
- features such as pools, riffles, bars and bank slopes
- sediment availability/transport
- interaction between a channel and its floodplain

  ecology and biology (i.e. habitats which support plants and animals)

B.2 Assessment Methodology

The aim of the assessment is to determine whether the proposed works could have an impact upon any of the above criteria. Those criteria for which no potential adverse effects are identified are not considered further in the assessment.

The following assessment objectives were used to determine whether the proposed works comply with the overarching objectives of the WFD. These objectives were therefore derived from the Environmental Objectives of the Directive:

- Objective 1: The proposed scheme does not cause deterioration in the Status of the Biological Elements of the waterbody.
- Objective 2: The proposed scheme does not compromise the ability of the waterbody to achieve its WFD status objectives.
- Objective 3: The proposed scheme does not cause a permanent exclusion or compromised achievement of the WFD objectives in other bodies of water within the same RBD.
- Objective 4: The proposed scheme contributes to the delivery of the WFD objectives.

In order to establish whether the scheme complies with the WFD it is necessary to ascertain whether the preferred options have the potential to result in:

- Failure of a water body to achieve good ecological status or potential; or
- Failure to prevent deterioration in the ecological status or potential of a water body.

If the answer to these questions is 'no' the strategy can be considered WFD compliant. If either of these failures is identified, further assessment may be required to identify if the strategy meets all of the conditions set out by the WFD Legislation.

B.3 Baseline Assessment

The Fealge river system through Clonakilty is considered to be in a 'moderate' condition (ecological and chemical) in the River Basin Management Plan, with an objective to be restored by 2021 to satisfy stated WFD targets.

A baseline assessment was conducted in 2014 to gain an understanding of the current character and dynamics of the catchment water bodies and help place their character in the historic context of channel engineering and management. This was achieved through a Fluvial Audit (hydromorphological field survey) and desk based assessment of the study reaches.

Figure C-1 : Gravel deposition in the upper reaches

The existing morphology throughout the Fealge River system is diverse and the bed of the channel is predominantly gravel based, operating naturally to move coarse sediment. This is supplied largely from glacial deposits being reworked from bank erosion and the bedrock dominated upper reaches which act to supply sediment entering the river in the upper reaches, downstream via a series of temporary in-channel bar stores. The majority of bars within the channel are dynamically stable and are replenished with sediment from upstream whilst also providing a source for transport to downstream reaches during geomorphologically effective flows.

Figure C-2 : Urban Constrictions and temporary flood defences

Several barriers exist to sediment transport (such as bridges and culverts) which are currently managed to prevent flooding. Within the urban areas the channel has been modified historically as the urban area has expanded. This has resulted in a loss of floodplain and a confined channel as a result of bankside development and flood embankment construction (Figure C-2). Under natural conditions, a river would flood its floodplain frequently, often for events in exceedance of the 1 in 2yr event. The river would also be able to erode laterally during geomorphologically effective flows (again, at a 1 in 2yr event or higher), this is currently prevented due to the significant bank protection works along the channel to protect nearby and bankside infrastructure. Therefore, the river is modified significantly when compared to likely natural processes associated to this river type.

Evidence of gravel deposition within these confined sections was strong. This suggests higher flow events through these areas are low energy which gives way for deposition. High energy events have the ability to deliver coarse gravel from upstream areas. As the flood event recedes sediment carried in suspension is deposited on to dynamically stable features (i.e. by replacing sediment already transported away). The maintenance of a coarse gravel bed suggests that there is sufficient energy within the system to prevent fine sediment deposition.

However, in areas where the channel has been artificially widened and realigned through the urban area, at structures for instance, fine sediment deposition occurs across the coarse gravel bed as a result of the reduced flow energy conditions created by the overwidening. This impacts the hydromorphological and ecological quality of the gravel bed.

The river throughout contains a good gravel substrate which can provide, in some locations, good places for fish spawning and a diverse hydromorphology characteristic of this active single thread river type. Any in channel works or permanent modifications to the channel bed, banks or floodplain could have an adverse impact upon in channel habitats and morphological features / processes. Spawning habitat availability in the lower reaches of the Feagle is limited, with low velocities due the tidal influence and the presence of weirs, resulting in increased fine sediment deposition.

The downstream reaches of the Fealge River are tidal. The Fealge discharges into the south-west of Clonakilty Bay alongside the Croppy Road, with a second smaller watercourse joining from the north-east at Facksbridge. Much of the tidal harbour area has been modified; however, limited evidence of excessive fine sediment deposition was seen within the fluvial channel. The estuarine zone has characteristic mudflat areas although the total surface area of these has been reduced in the past through reclamation of land now used predominantly for agriculture. The narrowing has created a relatively dynamic mudflat zone that could be sensitive to artificial modification.

B.3.1 Summary hydromorphological baseline condition

In the fluvial dominated zones the river system is significantly modified compared to natural conditions associated to a river of this type as a result of urbanisation leading to disconnection of the floodplain, channel realignment, in-channel structures impacting sediment transport and channel widening. However, in some areas, the quality of the gravel bed is high and is likely to provide suitable spawning habitat for fish.

Historic narrowing of the estuarine zone through land reclamation has created a dynamic mudflat zone that is likely to be sensitive to artificial modification.

B.4 Hydromorphological Impacts of the Proposed Scheme

B.4.2 Overview

The hydromorphological processes and response to the proposed flood relief scheme is important to understand due to the direct impact that it could have on altering flood capacity and changing flood risk levels. It is also important in terms of maintaining or improving biotic health through the creation and development of ecological habitats impacting on water body hydro-geomorphological status which is a fundamental component of the European Water Framework Directive (WFD).

Following the baseline assessment a desktop study was undertaken to determine whether the proposed flood scheme could have an impact upon any of the criteria set out in the WFD for hydromorphological condition and status.

A key factor in determining the short term constructability and long term viability of the proposed scheme will be the hydromorphological processes in operation throughout the river system, namely the processes of erosion and accretion, and materials being transported, and the timescales involved. This has been assessed through the high level hydromorphic audit involving a catchment baseline survey and local fluvial audit to determine the historic, current and likely future dynamics of the river, paying particular attention to the sediment transport regime (coarse and fine) and associated patterns of erosion and deposition. This has been discussed above in section B.3. The audit has concentrated on waterways directly impacted by the scheme but has also considered wider system response to disrupted / altered flow and transport processes.

The findings of the audit have been used to develop a conceptual model of the form and dynamics of the interacting watercourses allowing predictions to be made regarding potential flood works within Fealge catchment. This model will be key in ensuring a sustainable Water Framework Directive (WFD) compliant solution to the flooding problems that minimises hydromorphic impact elsewhere.

The proposed scheme has been assessed against the WFD objectives. The Fealge river system through Clonakilty is considered to be in a 'moderate' condition (ecological and chemical) in the River Basin Management Plan, with an objective to be restored by 2021 to satisfy stated WFD targets. The proposed scheme should not cause deterioration in the existing waterbody status and should not compromise its ability to achieve a future objective. Wider remediation may be required as reach scale impacts are possible as a result of the scheme, such as increased fine sediment deposition in the vicinity of the storage area due to dampened flows. Appropriate mitigation measures should be implemented, which could include restoration of the channel to reduce risk of excess deposition, to continue to promote sediment transport and to prevent deterioration of the gravel bed sections. Bed armouring may be required at the outfall.

B.4.3 Key considerations

- Any future scheme should not alter the morphology of the river or estuary in a way that means it is unable to achieve the WFD objectives by 2021. It should seek to improve hydromorphological and ecological condition wherever possible.
- The river throughout contains a good gravel substrate in some locations which can provide suitable places for fish spawning and a diverse hydromorphology characteristic of this river type. Structures can significantly alter the depth of water and velocity of flow, leading to over deepened, impounded reaches upstream and altering the habitat and hydromorphological characteristics. Any in channel works or permanent modifications to the channel bed, banks or floodplain could have an adverse impact upon in-channel habitats and morphological features / processes and measures should be taken to reduce any adverse impacts.

- Two key factors have been considered, firstly embankment raising which could elevate in channel energy levels during flood conditions by concentrating flows within the already confined channel and secondly the regulation of upstream flows which could lead to enhanced deposition and dampened downstream flows. However, as the existing bank full flows are expected to be maintained fine sediment should continue to be transported through the system during normal conditions. Nevertheless, the regulation of flows due to the creation of the storage area could lead to increased local deposition due to the dampening of flows, which could cause some downstream sediment starvation. It is recommended that monitoring of fine sediment deposition is carried out at the storage area site post construction. Any in channel works should not seek to act as a barrier to sediment transportation as this could create future erosion and / or deposition issues locally and downstream through sediment starvation and higher energy in channel flows

B.4.4 Incorporation of analysis model hydraulics

Following review of the initial hydromorphological conclusions from the hydromorphological audit, it was deemed necessary to undertake further assessment to determine the scale of potential impacts originally identified where uncertainties existed due to the lack of hydraulic model information available at the time of the initial assessment and where a precautionary assessment was therefore made.

Model hydraulic data has subsequently become available and the potential impacts of the proposed works have been able to be reassessed and updates have been made to the assessment table which is contained in section B.5 below. Assessment has been undertaken of the impacts on flow velocities for a variety of return period flood events (fluvial and tidal) pre and post the defence works throughout the model extent. It has also considered the potential temporary impacts during construction associated to the placement and use of a cofferdam to undertake the works. This has enabled conclusions to be made on the impacts on existing patterns of erosion and deposition. It should be noted that there are limitations to this analysis of data as it is based on 1D cross-sections where velocities are averaged across the channel and are also depth averaged. However, these are able to give a reasonable indication of impacts on the flow and sediment regime and certainly detail beyond which was previously available.

B.5 Summary of Impacts, Mitigation and Residual Impact Associated to Proposed Works

Defence Number	Description and extent of work	Hydromorphological impacts during construction and severity	Hydromorphological impacts of proposed defences on river processes and severity	Possible further assessment	Construction mitigation	Operation mitigation	Residual impacts
L38-L42 in Fig. 2-2	1.3 m high flood walls behind a number of properties on Convent Road. The flood walls will be replaced where required.	Low - The location of the proposed flood defence adjacent to buildings means damage to channel or floodplain features is unlikely.	Low - The location of the proposed flood defence is set back from the river bank and is unlikely to significantly impact river and estuarine processes under normal or flood flows.	n/a	n/a	n/a	n/a
E10 on Fig. 2-2	1.4 m high embankment behind the houses on the Old Timoleague Road. The embankment will be 60 m long. It is estimated that 150 m3 of impermeable material will be required. That equates to approx. 300 tonnes of material.	Low – The location of the proposed flood defence is within a previously reclaimed mudflat area and therefore construction impacts on estuarine condition are likely to be low. Impacts will be to the now farmed land.	Low – The location of this defence is on reclaimed estuarine margins and mudflats that are now farmed. The impacts to the mudflat features and estuarine processes are therefore likely to be low under normal and flood flows.	n/a	n/a	n/a	n/a
R1 on Fig. 2-2	1.6 m high flood walls and raise the Ring Road to 1.7 m along a 220 m section of the road.	Low/Med – Damage could be caused during construction to the adjacent mudflat neighbouring the proposed defence location.	Low – The location of the proposed defence running along the fringe of a mudflat feature could cause increased scour as a result of higher flow energy conditions created	n/a	Minor increases in velocities would be expected due to use of the cofferdam during construction but again these remain	n/a	n/a

Defence Number	Description and extent of work	Hydromorphological impacts during construction and severity	Hydromorphological impacts of proposed defences on river processes and severity	Possible further assessment	Construction mitigation	Operation mitigation	Residual impacts
			by the increased defence height. This risk has been further assessed and the impacts on model velocities are minimal with the velocities remaining within a depositional range (0.1-0.2m/s) across the flow regime. In addition, the defences will only influence hydraulics during extreme flows which are infrequent.		within the depositional range and therefore impacts will be low. Careful removal of cofferdams to allow the natural re-instatement of the mudflat by tidal inundation and sediment deposition.		
L36 on Fig. 2-2	1.1 m – 1.3 m high flood walls along Croppy Road between Fracksbridge and Clarke's Bridge. The wall will be constructed at ground level, no requirement for in-river works. Wall will be fronted with local stone.	Low/Med – Construction of this bankside defence could impact the neighbouring mudflat. Likely to be fine sediment release into channel.	Low – The construction of this bankside defence along Croppy Road could further heighten in-channel energy levels during flood conditions, potentially mobilising some of the coarse gravel substrate and preventing deposition. Risk of increased scour of neighbouring mudflat. These risks have been assessed through review of model velocities at this location and there is a small increase in maximum velocities (0.06m/s) across the flow regime meaning negligible changes to	n/a	Careful removal of cofferdams to allow the natural re-instatement of the mudflat by tidal inundation and sediment deposition. Suitable fine sediment management measure or diversion of channel during works to prevent significant delivery of fines. However, impact of fine sediment release likely to be short	Consider reconnection of floodplain in other acceptable zones. Set back defence wherever possible. .	Bankside defence could reduce deposition and formation of gravel features and a good condition gravel bed although considered to be a low risk.

Defence Number	Description and extent of work	Hydromorphological impacts during construction and severity	Hydromorphological impacts of proposed defences on river processes and severity	Possible further assessment	Construction mitigation	Operation mitigation	Residual impacts
			patterns of erosion and deposition.		term and should be assimilated into the normal flow regime. There are up to 0.5m/s increases in velocities whilst the cofferdam is in place at this location although as this will be for a short period of time, this is unlikely to cause any significant degradation to the channel or banks.		
L35 on Fig. 2-2	1.2 m flood defence wall from Clarke's Street Bridge, along the South Bank of the river and tying into the waste water treatment plant embankment (TD/E2). This will be a reinforced concrete wall and some in-river works will be required.	Medium - Construction of this bankside defence could impact the neighbouring mudflat. Likely to be fine sediment release into channel. Potential damage to in-channel fine and coarse sediment features.	Low - The construction of this bankside defence could further heighten in-channel energy levels during flood conditions, potentially mobilising some of the coarse gravel substrate and preventing deposition. Risk of increased scour of neighbouring mudflat. Risk of increased scour of neighbouring mudflat. These risks have been assessed through review of model velocities at this location and there is a small increase in	n/a	Careful removal of cofferdams to allow the natural re-instatement of the mudflat by tidal inundation and sediment deposition. Suitable fine sediment management measure or diversion of channel during works to prevent significant delivery of fines. However,	Consider reconnection of floodplain in other acceptable zones. Set back defence wherever possible.	Bankside defence could reduce deposition and formation of gravel features and a good condition gravel bed although considered to be a low risk.

Defence Number	Description and extent of work	Hydromorphological impacts during construction and severity	Hydromorphological impacts of proposed defences on river processes and severity	Possible further assessment	Construction mitigation	Operation mitigation	Residual impacts
			maximum velocities (0.06m/s) across the flow regime meaning negligible changes to patterns of erosion and deposition.		impact of fine sediment release likely to be short term and should be assimilated into the normal flow regime. There are up to 0.5m/s increases in velocities whilst the cofferdam is in place at this location although as this will be for a short period of time, this is unlikely to cause any significant degradation to the channel or banks.		
E9 on Fig. 2-2	0.7 m high flood defence embankment at the boundary of the Waterfront Development and the Waste Water Treatment Plant.	Low – The location of the proposed defence is setback from the bank edge and is not immediately adjacent to a mudflat, therefore hydromorphic impact is low.	Low - The location of the proposed flood defence is set back from the river bank and is unlikely to significantly impact river and estuarine processes under normal or flood flows	n/a	n/a	n/a	n/a
B7 on Fig. 2-2	Solid parapets on Clarke's Street Bridge. All works conducted at ground level.	Low – Works not likely to involve in-channel works.	Low – Possible minor increase in impoundment length upstream as a result of solid parapets during flood flows, possibly increasing	n/a	n/a	n/a	n/a

Defence Number	Description and extent of work	Hydromorphological impacts during construction and severity	Hydromorphological impacts of proposed defences on river processes and severity	Possible further assessment	Construction mitigation	Operation mitigation	Residual impacts
			deposition above existing rates at a low level. The impacts on model velocities are negligible.				
B6 on Fig. 2-2	Replace railings with solid parapets in Seymour Street Pedestrian Bridge. All work done at ground level.	Low – Works not likely to involve in-channel works.	Low – Possible minor increase in impoundment length upstream as a result of solid parapets during flood flows, possibly increasing deposition above existing rates at a low level. The impacts on model velocities are negligible.	n/a	n/a	n/a	n/a
L32-L34 on Fig. 2-2	1.3 m high flood walls on both banks between Seymour Street Pedestrian Bridge and Clarke's Street Bridge. A new wall will be required on the northern bank. Assume in-river works.	Medium - Construction of this bankside defence could impact the channel bed and any neighbouring gravel features. Likely to be fine sediment release into channel.	Low - The construction of this bankside defence could further heighten in-channel energy levels during flood conditions, potentially mobilising some of the coarse gravel substrate and preventing deposition. There are minor increases in channel maximum velocities within the channel locally across the flow regime (up to 0.02m/s) therefore the risk of any significant changes to the patterns of erosion and deposition are low.	n/a	Reinstate damaged sediment features and bed once construction is complete. Suitable fine sediment management measure or diversion of channel during works to prevent significant delivery of fines. However, impact of fine sediment release likely to be short term and should be assimilated into the normal flow regime. The	Consider reconnection of floodplain in other acceptable zones. Set back defence wherever possible.	Bankside defence could reduce deposition and formation of gravel features and a good condition gravel bed.

Defence Number	Description and extent of work	Hydromorphological impacts during construction and severity	Hydromorphological impacts of proposed defences on river processes and severity	Possible further assessment	Construction mitigation	Operation mitigation	Residual impacts
					influence of the cofferdam during construction gives a small reduction in flow velocities for the 1 in 2yr event (0.2-0.4m/s) but due to the temporary nature of the cofferdam, it is unlikely to result in significant deposition.		
L20-L24 on Fig. 2-3	1.1 m high flood walls on both sides of the banks between library and Rossa Street Bridge. Assume new walls will be required. Assume in-river works required for this construction.	Medium - Construction of this bankside defence could impact the channel bed and any neighbouring gravel features. Likely to be fine sediment release into channel.	Medium - The construction of this bankside defence could further heighten in-channel energy levels during flood conditions, potentially mobilising some of the coarse gravel substrate and preventing deposition.	Interrogate hydraulic model hydraulics to determine impacts on erosion and deposition.	Reinstate damaged sediment features and bed once construction is complete. Suitable fine sediment management measure or diversion of channel during works to prevent significant delivery of fines. However, impact of fine sediment release likely to be short term and should be assimilated into the normal flow regime.	Consider reconnection of floodplain in other acceptable zones. Improve hydromorphological condition of channel elsewhere. Set back defence wherever possible.	Bankside defence likely to reduce deposition and formation of gravel features and a good condition gravel bed.
B2 and B3	Replacement of	Low – Works not likely	Low – Possible minor	Interrogate	n/a	None unless a	Possible minor

Defence Number	Description and extent of work	Hydromorphological impacts during construction and severity	Hydromorphological impacts of proposed defences on river processes and severity	Possible further assessment	Construction mitigation	Operation mitigation	Residual impacts
on Fig. 2-3	railings on Credit Union Pedestrian Bridge with solid parapets. All work carried out at ground level.	to involve in-channel works.	increase in impoundment length upstream as a result of solid parapets during flood flows, possibly increasing deposition above existing rates at a low level.	hydraulic model hydraulics to determine impacts on erosion and deposition.		risk of deposition increase upstream, if so, consider alternative design.	increase in sedimentation upstream as a result of increased impoundment length during flood flows.
L25-L31 on Fig. 2-2	1.1 -1.3 m high flood walls on both banks between Rossa Street Bridge and Seymour Street Pedestrian Street Bridge. The walls on the north bank will be replaced. Assume in-river works.	Medium - Construction of this bankside defence could impact the channel bed and any neighbouring gravel features. Likely to be fine sediment release into channel.	Medium - The construction of this bankside defence could further heighten in-channel energy levels during flood conditions, potentially mobilising some of the coarse gravel substrate and preventing deposition.	Interrogate hydraulic model hydraulics to determine impacts on erosion and deposition	Reinstate damaged sediment features and bed once construction is complete. Suitable fine sediment management measure or diversion of channel during works to prevent significant delivery of fines. However, impact of fine sediment release likely to be short term and should be assimilated into the normal flow regime.	Consider reconnection of floodplain in other acceptable zones. Improve hydromorpholo gical condition of channel elsewhere. Set back defence wherever possible.	Bankside defence likely to reduce deposition and formation of gravel features and a good condition gravel bed.
L20-L24 on Fig. 2-3	1.1 m high walls on both banks between Library and Rossa Street Bridge. Assume new	Medium - Construction of this bankside defence could impact the channel bed and any neighbouring gravel features. Likely to be	Medium - The construction of this bankside defence could further heighten in-channel energy levels during flood conditions,	Interrogate hydraulic model hydraulics to determine impacts on	Reinstate damaged sediment features and bed once construction is complete. Suitable fine	Consider reconnection of floodplain in other acceptable zones.	Bankside defence likely to reduce deposition and formation of gravel features

Defence Number	Description and extent of work	Hydromorphological impacts during construction and severity	Hydromorphological impacts of proposed defences on river processes and severity	Possible further assessment	Construction mitigation	Operation mitigation	Residual impacts
	walls will be required. Assume in-river works required for this construction.	fine sediment release into channel.	potentially mobilising some of the coarse gravel substrate and preventing deposition.	erosion and deposition	sediment management measure or diversion of channel during works to prevent significant delivery of fines. However, impact of fine sediment release likely to be short term and should be assimilated into the normal flow regime.	Improve hydromorphological condition of channel elsewhere. Set back defence wherever possible.	and a good condition gravel bed.
L16-L19 on Fig. 2-3	1.1 m high flood walls on both banks between Michael Collins Bridge and the Library. Assume repairs and possible replacement of sections. Will require in-river works.	Medium - Construction of this bankside defence could impact the channel bed and any neighbouring gravel features. Likely to be fine sediment release into channel.	Medium - The construction of this bankside defence could further heighten in-channel energy levels during flood conditions, potentially mobilising some of the coarse gravel substrate and preventing deposition.	Interrogate hydraulic model hydraulics to determine impacts on erosion and deposition.	Reinstate damaged sediment features and bed once construction is complete. Suitable fine sediment management measure or diversion of channel during works to prevent significant delivery of fines. However, impact of fine sediment release likely to be short term and should be assimilated into the normal flow	Consider reconnection of floodplain in other acceptable zones. Improve hydromorphological condition of channel elsewhere. Set back defence wherever possible.	Bankside defence likely to reduce deposition and formation of gravel features and a good condition gravel bed.

Defence Number	Description and extent of work	Hydromorphological impacts during construction and severity	Hydromorphological impacts of proposed defences on river processes and severity	Possible further assessment	Construction mitigation	Operation mitigation	Residual impacts
					regime.		
D11 on Fig. 2-2	Underground pumping station at Croppy Road.	n/a	n/a	n/a	n/a	n/a	n/a
D10 on Fig. 2-2	Underground pumping station at Old GAA grounds.	n/a	n/a	n/a	n/a	n/a	n/a
D6 on Fig. 2-3	Underground pumping station at Rossa Street.	n/a	n/a	n/a	n/a	n/a	n/a
D3 on Fig. 2-3	Underground pumping station at Kent Street.	n/a	n/a	n/a	n/a	n/a	n/a
Reservoir upstream of Clonakilty town, including new walls and sluice **E6, E7 and E8 on Fig. 2-6** **Sl1 and Sl2 on Fig. 2-6** **H1,H2,H3,H4 on Fig. 2-6**	Proposed flood storage reservoir. Storage volume of 474,847 m3 including construction of embankment and sluice.	Medium – works involved in installation of the sluice and possible walls are likely to disturb channel banks and possibly the channel bed.	Medium – Operation of the reservoir is likely to create dampened flow energy levels within the river when the reservoir fills. This could result in deposition of sediment, fine and coarse within the channel. Elevated deposition here could impact sediment transport to downstream reaches, meaning the condition of the gravel bed downstream could deteriorate. There could be a reduction of flow energy downstream of the reservoir when it is operated, leading to	Interrogate hydraulic model hydraulics to determine impacts on erosion and deposition, both local to the reservoir and up and downstream.	Reinstate damaged sediment features and bed once construction is complete. Suitable fine sediment management measure or diversion of channel during works to prevent significant delivery of fines. However, impact of fine sediment release likely to be short term and should be assimilated into the normal flow	Wider remediation may be required as reach scale impacts are possible as a result of this option. This could include restoration of the channel to reduce risk of excess deposition, to continue to promote sediment transport and to prevent	Risk of elevated deposition local to the reservoir. Scour at the outfall. Disruption of sediment transport to downstream reached. Fine sediment deposition downstream due to infrequent high flow events.

Defence Number	Description and extent of work	Hydromorphological impacts during construction and severity	Hydromorphological impacts of proposed defences on river processes and severity	Possible further assessment	Construction mitigation	Operation mitigation	Residual impacts
			deposition of sediment and possible consolidation of fines within the channel as a result of less frequent high energy flows. There is a risk of channel incision downstream as a result due to the 1 to 2 yr frequency of operation of the reservoir on average. New walls lining the channel could restrict potential lateral activity of the channel and increase the risk of erosion downstream of the new walls. Risk of scour at the outfall where high velocities are predicted that are strong enough to move cobble sized material.		regime.	deterioration of the gravel bed sections. Bed armouring may be required at the outfall.	
Do nothing	Assumes no defences are constructed	n/a	There are currently significant artificial modifications to the Feagle system with the fluvial and estuarine zones that work against natural processes associated to these systems. Therefore, hydromorphological condition is already significantly modified.	n/a	n/a	Reduce artificial pressures on the estuarine and fluvial systems wherever feasible.	n/a

Defence Number	Description and extent of work	Hydromorphological impacts during construction and severity	Hydromorphological impacts of proposed defences on river processes and severity	Possible further assessment	Construction mitigation	Operation mitigation	Residual impacts
			However, mudflat condition is generally good, as is the coarse gravel substrate of the river in many locations. This is likely to remain in the medium term. Longer term, the existing modifications are likely to restrict the development of mudflats, creating a dynamic zone within the constrained estuarine area. The gravel bed of the river will continue to be dynamics.				

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