VOLUME I: Non-Technical Summary of the Environmental Impact Assessment Report

Graiguenamanagh – Tinnahinch Flood Relief Scheme

Report No. W3451-ENV-R008

September 2025

Revision 00

Kilkenny County Council

Preface

This Environmental Impact Assessment Report for Graiguenamanagh-Tinnahinch Flood Relief Scheme comprises three volumes as follows:

Volume I – Non-Technical Summary

Volume II – Main Environmental Impact Assessment Report

Volume III – Technical Appendices

This document is Volume I – Non-Technical Summary. This document is a simplified version of the detailed Environmental Impact Assessment Report (Volume II) and summarises the key findings in a clear, accessible format that uses non-technical language and supporting graphics.

Document Control

Project

Graiguenamanagh – Tinnahinch Flood Relief Scheme

Client

Kilkenny County Council

Document

VOLUME I: Non-Technical Summary of the Environmental Impact Assessment Report

Report Number:

W3451-ENV-R008

Document Checking:

Date	Rev	Details of Issue	Prepared by	Checked by	Approved by
September 2025	00	For Planning	Andrea Brogan	Jackelyn Wren	Barry Sheridan
August 2025	Draft A	DRAFT issued for Client Review	Andrea Brogan	Jackelyn Wren	Barry Sheridan

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Contents

Glossary of Terms and Abbreviations

%	Percentage
I	One
II	Two
III	Three
ACA	Architectural Conservation Area
AEP	Annual Exceedance Probability
AFA	Area for Further Assessment
c.	Approximately
CEMP	Construction Environmental Management Plan
CFRAMS	Catchment Flood Risk Assessment and Management Study
Co.	County
DCCAE	Department of the Environment, Climate and Communications
DCHG	Department of Culture, Heritage and the Gaeltacht
EC	Executive Council
EIA	Environmental impact assessment
EIAR	Environmental impact assessment report
Eir	Eircom Limited
EirGrid	EirGrid Group
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ESB	Electricity Supply Board
EU	European Union
FRMP	Flood Risk and Management Plan
FRS	Flood Relief Scheme
FSU	Flood Studies Update
GIS	Geographic Information Systems
GLAP	Graiguenamanagh Local Area Plan
GSI	Geological Survey Ireland
GTFRS	Graiguenamanagh-Tinnahinch Flood Relief Scheme
HLC	Historic Landscape Characterisation
IFI	Inland Fisheries Ireland
IPCC	Irish Peatland Conservation Council
KCC	Kilkenny County Council
km	Kilometres

km^2	Kilometres squared
kV	Kilovolt
LAP	Local Area Plan
LCA	Landscape Character Assessment
NBDC	National Biodiversity Data Centre
NHA/ pNHA	Natural Heritage Areas / Proposed Natural Heritage Areas
NIAH	National Inventory of Architectural Heritage
NMS	National Monuments Service
NPWS	National Parks and Wildlife Service
NTA	National Transport Authority
OPW	Office of Public Works
PA	Project Archaeologist
Pers. Comm.	Personal Communication
Pre-WFD	Pre-Water Framework Directive
QI	Qualifying Interests
Q-value	Biological River Quality Classification System
RMP	Record of Monuments and Places
RPS	Record of Protected Structures
SAC	Special Areas of Conservation
SCI	Sites of Community Importance OR Species of Conservation Interest
SEA	Strategic Environmental Assessment OR Social and Environmental Assessment
SI	Site Investigation OR Statutory Instrument
SL	Speed Limit
SMR	Sites and Monuments Record
SPA	Special Protection Area
sp.	Species (singular)
spp.	Species (plural)
TII	Transport Infrastructure Ireland
UNESCO	United Nations Educational, Scientific and Cultural Organization
WFD	Water Framework Directive
WHS	World Heritage Site
WwTP	Wastewater Treatment Plant
ZAP	Zone of Archaeological Potential

1 Outline Details

1.1 Introduction

1.1.1 This document comprises the Non-Technical Summary (NTS) for the Environmental Impact Assessment Report (EIAR) prepared for the proposed Graiguenamanagh-Tinnahinch Flood Relief Scheme (hereafter referred to as 'the Proposed Scheme').

1.1.2 There are five stages in the Project:

- Stage I – Development of a number of flood defence options and the identification of a preferred Scheme.
- Stage II – Planning .
- Stage III – Detailed Design & Tender.
- Stage IV – Construction.
- Stage V – Project Close-Out (Handover to Client).

1.1.3 This Non-Technical Summary is produced as part of Stage II of the project, and provides a summary of the EIAR prepared for the Project, which comprises three volumes as follows:

- Volume I - Non-Technical Summary
- Volume II - EIAR (Main Text)
- Volume III - Appendices

1.2 Requirement for an Environmental Impact Assessment (EIA) and Process

1.2.1 EIA is a procedure required under the terms of EU Directive 2014/52/EU, transposed into Irish Law through the European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018 (SI 296 of 2018). This directive requires an assessment of the effects of certain public and private projects on the environment. Ireland implements this Directive through the Planning and Development Regulations 2001-2020.

1.2.2 The mandatory requirement is generally based on the nature or scale of a proposed development, as set out in EU Directive 85/337/EEC (as amended by Directive 97/11/EC). The Planning and Development Regulations 2001-2020 – Schedule 5 also identify certain types and scales of development, generally based on thresholds of scale, for which an EIA is mandatory. The EIAR is produced in stages, described below.

Initial Screening

1.2.3 The prescribed classes of development and thresholds that trigger a mandatory EIA are set out in Schedule 5 Part 1 and 2 of the Planning and Development Regulations, 2001, as amended. The most relevant criterion for the Proposed Scheme is Class 10 of Part 2 of Schedule 5. In the case of the Proposed Scheme, the length of river channel on which works are proposed exceeds 2km and the contributing sub-catchment of the proposed works is >100 hectares. The extent of the contributing Duiske sub-catchment is >440 hectares with a river channel reach of 4.35km within the catchment.

1.2.4 The Proposed Scheme therefore exceeds the thresholds for mandatory EIA and falls within the criteria set out for which an EIA is required.

Informal Environmental Scoping

1.2.5 The Scoping Report identified the key elements that would have the potential to result in impacts on the environs of the site. It was decided that the EIA Scoping Report would not be issued to ABP for formal opinion but would support in identifying the key elements that would have the potential to result in impacts on the environs of the site. This exercise also assisted in determining the nature and level of detail of information to be contained in the EIAR, essentially determining what is to be 'scoped in' and 'scoped out' of the EIAR. This informal process meant statutory bodies that have an interest or who may be affected by the development, as well as non-governmental organisations and other relevant organisations were contacted, and the Scoping Report was circulated to them.

Impact Assessment & Description of Effects

1.2.6 The EIAR has been prepared to provide information on the likely significant effects of the Proposed Scheme on the environment as per the Planning and Development Regulations 2001 (as amended by Schedule 6 of the European Union (Planning and development) (Environmental Impact Assessment) Regulations 2018, (S.I. No. 296 of 2018)

1.2.7 The criteria for the presentation of the characteristics of potential significant effects are described with reference to the magnitude, spatial extent, nature, complexity, probability, duration, frequency, reversibility, cumulative effect and transboundary nature (if applicable) of the effect. The environmental impacts for each relevant topic is predicted by determining the baseline environmental conditions which is the situation without the Proposed Scheme. This is then compared to the conditions that would prevail if the Proposed Scheme were to go ahead.

1.2.8 The classification and description of effects in the Proposed Scheme's EIAR follows the terms provided in Table 3.4 of the EPA Guidelines (2022). Other environmental impact assessment guidelines are published by national statutory bodies such as the Transport Infrastructure Ireland (TII) or the National Roads Authority (NRA) and are specific to certain environmental parameters. In these cases, the most appropriate guidelines have been used in the conduct of the impact assessment and, where used, are referenced in the respective chapters.

1.2.9 The assessment of each environmental aspect has been undertaken for the 'do nothing' scenario (i.e., effects should the project not be carried out), the 'construction phase' and the 'operation and maintenance phase' of the Proposed Scheme.

1.2.10 For each significant adverse effect that has been identified by this EIAR, potential mitigation and monitoring measures have been reviewed by the competent experts, consistent with statutory requirements and good industry practice in their respective field. The likely residual environmental impact(s) for each environmental topic are then outlined, determined through a review of what likely remaining impact is following implementation of the suggested mitigation and monitoring measures.

2 Description of the Proposed Scheme

2.1 Need for the Scheme

2.1.1 The towns of Graiguenamanagh in County Kilkenny, and Tinnahinch in County Carlow, have a history of flooding. The two towns are separated by the River Barrow which causes flooding when the channel exceeds its capacity. The Barrow River Basin is predominantly rural and agricultural in nature and covers an area of 3,025 km^2 and includes much of County Carlow, portions of south Kildare, east Laois, southeast Offaly, east Kilkenny and small areas within west Wexford and Wicklow. The main river in this area is the River Barrow and its tributaries. Graiguenamanagh and Tinnahinch (G-T) are located on the River Barrow with the Duiske River, a tributary of the River Barrow, running through the town of Graiguenamanagh.

2.1.2 The River Barrow drains a large catchment and has typically risen slowly during historical flood events. During these events, the two effected areas are the quay front of Graiguenamanagh and the quay front of Tinnahinch. The River Duiske is a small flashy river that flows through the town of Graiguenamanagh before joining the River Barrow. During past flood events, out of bank flow from the River Duiske has travelled through Graiguenamanagh affecting residential and commercial properties along Main Street and Turf Market area, as reported during 2015/2016 flood events. A total of 17 reports of flood events have been cited between 1930 and 2020. There have been no flood events since 2020.

2.1.3 As a result of these flood events, it was determined that a flood relief scheme was viable and effective for the community. Kilkenny County Council (KCC), through partnership with the Office of Public Works (OPW) and Carlow County Council (CCC), is progressing the Proposed Scheme.

2.2 Scheme Objectives

2.2.1 The objective of the Proposed Scheme is to deliver a Flood Relief Scheme, that is technically, socially, environmentally and economically acceptable, to alleviate the risk of flooding to the communities of Graiguenamanagh and Tinnahinch in accordance with the standards of the EU Directive on the Assessment and Management of Flood Risk (Floods Directive 2007/60/EC) transposed into Irish Law as SI 122 of 2010.

2.2.2 The Proposed Scheme will be designed to provide protection to properties in the study area from the 1% Annual Exceedance Probability (commonly known as the 1 in 100-year) flood event. There is also an objective to not contribute to an increase in water levels, whether upstream or downstream of the Scheme Area, as a result of the implementation of the GTFRS preferred measure.

2.3 Site Description

2.3.1 The settlement of Graiguenamanagh-Tinnahinch is situated on the River Barrow in the steep sided valley between Brandon Hill in County Kilkenny and Mount Leinster in County Carlow. It is a rich cultural town located 16km from Thomastown, 33km from Kilkenny City,

40km from Carlow, 19km from New Ross and 41km from Waterford City. The settlement also occupies a bridging point at George Semple Bridge, where the River Duiske enters the River Barrow, which divides Tinnahinch from Graiguenamanagh, and which offers amenity for boating, fishing and recreational pursuits. Graiguenamanagh town also has rich heritage. This is addressed further in Section 4.4.

2.3.2 The catchment areas are highlighted in Figure 2-1, and an aerial image of the towns and scheme area in Figure 2-2.

Figure 2-1: Study Area highlighting Barrow and Duiske Catchments

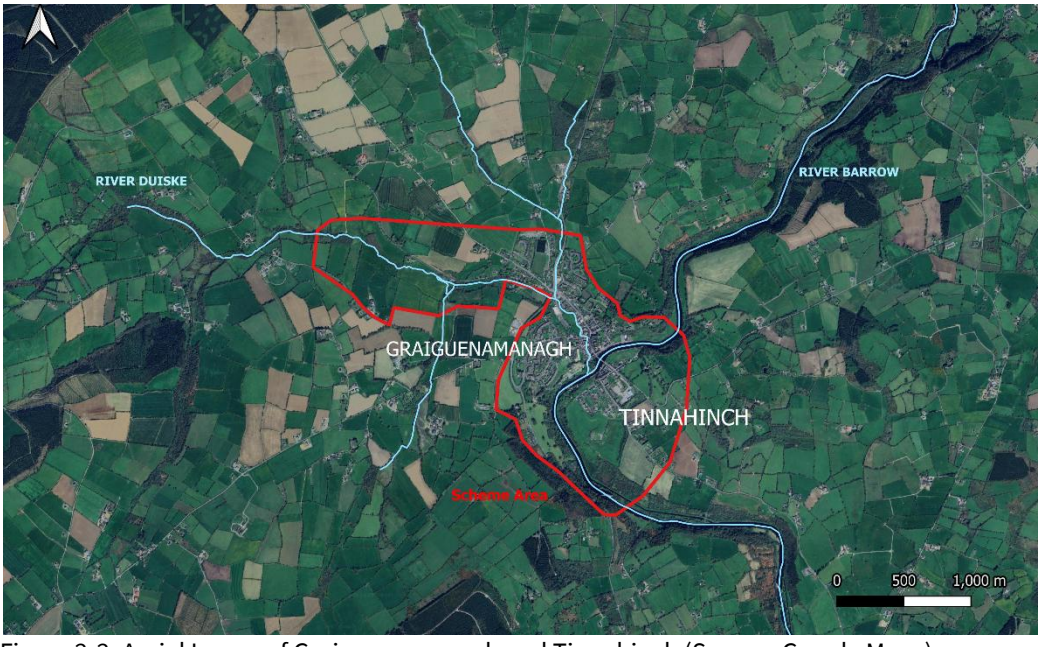

Figure 2-2: Aerial Image of Graiguenamanagh and Tinnahinch (Source: Google Maps)

2.4 Scheme Description

2.4.1 The Proposed Scheme comprises the following:

- Upstream Storage:
    - Installation of flood storage area approximately 1.5km upstream from the River Barrow and River Duiske confluence. The storage area will consist of a grass seeded fill material embankment that ranges from 0-8m above existing ground level, with side slopes at a ratio of 3:1. The embankment length will tie into the existing high ground to hold a flood storage extent of approximately 0.074 km^2.
    - A flow control device will be constructed in the centre of the embankment within the Duiske channel which will include debris screen on the upstream side to prevent blockages.
    - Road and associated services into the surrounding landscape, tree, hedge, riparian planting and wildflowers meadows have been proposed to assist integration of the embankment.
- River Duiske Defences:
    - New raised defences (concrete wall) along one or both left and right banks at various locations of the River Duiske.
    - A new raised defence (earthen embankment) along the eastern boundary of the Hub. The embankment will be 62m in length with side slopes of 1V:2.5H and will be grass seeded. Formal and informal pathways and planting are to be provided throughout the area, linking the area to the town, and residential area to the west. These will also provide linkage to the South Leinster Way/Brandon Hill.
    - Wall improvements on the left bank of the River Duiske, upstream of the High Street Bridge to Clapper Bridge. Ornamental planting is proposed between the proposed flood wall and the existing stone wall. Further steps are to be introduced towards Clapper Bridge with guardrails/handrails.
    - Installation of debris trap upstream of Clapper Bridge.
    - Removal and raised replacement of two existing foot bridges, near the Mass Path and at Turf Market.
- River Barrow Defences:
    - Defences at the Graiguenamanagh Rowing Club consist of hard and soft defences set back from the Quayside. The flood defence wall in front of the Club will be circa 1.5 m high above ground level and will include 1 m high glazing within its height in front of the clubhouse. The riverward side of the wall will be clad in natural stone. A soft earthen embankment will be constructed 1.8m high nearest to the river and will tie into high ground to the North of the building. The embankment will have side slopes of 1V:2.5H and will be grass seeded. For

the southern vehicular access to the Boathouse, a double gate arrangement is proposed to allow for pedestrian access to facilities while providing a secure boundary to the boathouse. Mooring and boat access will be available along the length of The Quay. Further, the slipway and concrete steps opposite the Boat Club will remain. The vehicular route within the club carpark will be altered to a one-way system for safer pedestrian movements.

- A new raised defence (cladded concrete wall) will be constructed from the Rowing Club along Graiguenamanagh Quay and will tie into the existing wall near the junction of Barrow Lane. A flood gate will be installed across the junction to the Rowing Club, flushed with the flood defence walls. This flood gate will restrict access to the Club during flood conditions.
- A new raised defences (concrete cladded and glass wall)) upstream of the Graiguenamanagh Bridge to tie into the flood gate at the Graiguenamanagh Rowing Club/Barrow Lane junction. The vehicular route will be altered to a one-way system, with wider footpaths proposed for easier and safer pedestrian movement and permeability.
- Flood gates will be placed along Graiguenamanagh Quay and Tinnahinch Quay to retain access for water activities. These will be closed in flood conditions.
- A new raised defence (flood wall) downstream of the Graiguenamanagh Bridge that will follow the already existing natural line of the edge of the carriageway.
- A new raised defence (earthen embankment) on the left bank upstream of the Graiguenamanagh Bridge. The embankment will be circa 240 m long with a maximum height of 1.25 m above ground level. The embankment will have side slopes of 1V:2.5H and will be grass seeded. The embankment will include maintenance access path. The embankment will tie into a flood defence wall on the upstream end. The concrete wall is 38 m long and will be circa 1.5 m high
- A new raised defence (flood concrete walls) on the left bank downstream of Graiguenamanagh Bridge along Tinnahinch Quay.
- Installation of non-return valves on outfalls to the River Barrow.
- Behind wall drainage improvements/pumping stations

2.4.2 The Proposed Scheme has been divided into works areas. They are outlined below with a description of their permanent works.

Table 2-1: Proposed Scheme Overview

Area No.	Description	Aspects of Work
Area 1	Storage Area	Raised earth-filled impoundment structure and debris screen. Reinforced concrete flow control structure with hydraulic control and downstream flume for flow control. Spillway.

Area No.	Description	Aspects of Work
		New access roads, lighting and mechanical and electrical equipment to storage area. Diversion of ESB poles. Tree planting and wildflower meadow to be integrated into the lands.
Area 2	Well Lane to High Street Bridge	Raised defence on the left bank from The Globe upstream to the first pedestrian access bridge. Local land raising/steps to tie into new raised flood defences. Removal and replacement of pedestrian access bridge deck and railings. Local waterproofing of existing walls and raising of windowsills. Debris Trap at Well Lane. Installation of Non-Return Valves (NRVs) at outfalls.
Area 3	Turf Market	Raised defences on left bank from High Street Bridge downstream to first pedestrian access bridge. Replacement pedestrian access bridge and parapets. Installation of NRVs at outfalls on left bank.
Area 4	Turf Market to The Hub (Lower Turf Market)	Raised defences on both banks from Turfmarket Bridge to the bridge at The Hub. Drainage system at Peg Washingtons Lane.
Area 5	Boat Club	Raised embankment on the right bank in the field north of the boat club. Raised defence on the right bank, to include part glass panels, from upstream of the boat club to Graiguenamanagh Quay. Installation of non-return valves on outfalls to the River Barrow. Drainage system to include pumped rising main. Local land raising to facilitate orderly completion of flood defences whilst maintaining access. Public Realm/landscaping works.
Area 6	Graiguenamanagh Quay	Raised defence on the right bank along Graiguenamanagh Quay to include glass wall section and sliding flood gates. Installation of non-return valves on outfalls to the River Barrow. Drainage system. Public Realm/Landscaping Works to include new 1-way system on Graiguenamanagh Quay. Install NRVs at outfalls.

Area No.	Description	Aspects of Work
		Undergrounding and diversion of ESB and Eir cables.
Area 7	The Dock	Raised defence on the right bank from Graiguenamanagh Quay to the bridge at The Hub to include hinged flood gate for access to historic dock. Drainage system and a pumping station. Landscape and Public Realm Works.
Area 8	The Hub	Raised defence on the right bank from the bridge at The Dock to the rear of the IW pumping station. Raised embankment on the right bank within the ground of The Hub. Local land raising to facilitate orderly completion of flood defences whilst maintaining access. Drainage System. Install NRVs at outfalls.
Area 9	Hotel Street	Raised embankment and flood wall with flood gate on the left bank in the field upstream of Graiguenamanagh Bridge. Groundwater drainage systems to tie into drainage on Tinnahinch Quay. Local ramps to maintain access to Barrow River. Install NRVs at outfalls.
Area 10	Tinnahinch Quay	Raised defences on the left bank at Tinnahinch Quay to the mill channel. Drainage systems and a pumping station. Automated sluice gate installation at Tinnahinch Mill head race. Install Non-Return Valves (NRV)s at outfalls. Undergrounding and diversion of ESB and Eir cables.

2.5 Construction Sequencing

2.5.1 Construction works are expected to commence in 2028 and the proposed construction period is an estimated 36-42 months. The construction is proposed to occur in Works Packages (WPs), broken down by overarching areas as shown below.

Table 2-2: Works Packages

Works Package No.	Works Package Duration	Works Package Description	Area No.	Site Compound to be Used
WP1	3 months	Site set-up, enabling works and early landowner accommodation works.	-	Main Compound (A)

Works Package No.	Works Package Duration	Works Package Description	Area No.	Site Compound to be Used
WP2	18 months	Construction of the storage areas to include power supply, access roads, embankment, flow control structure, spillway and associated works.	Area 1	Storage Area (B)
WP3	12 months	Construction of all flood defence walls on the Duiske River, replacement of 2no. Bridges, reinstatement of footpaths and private land and associated works.	Area 2 Area 3 Area 4	Well Lane to High Street Bridge (C)
WP4A	18 months	Construction of all flood defence walls on the River Barrow right bank, including drainage and pumping stations, utility diversions, public realm works, flood barriers, glass wall, boardwalk, public lighting, seating, trees and planters and associated works.	Area 5 Area 6 Area 7 Area 8	Boat Club (D)
WP4B	18 months	Construction of all flood defence walls and embankments on the River Barrow left bank, including drainage and pumping stations, utility diversions, reinstatement of roads and associated works.	Area 9	Hotel Street (E)

3 Consultation and Stakeholder Engagement

3.1.1 Consultation is an ongoing part of the EIAR process, and it is implemented from the Screening Stage onward. The EIAR requirements for consultation are defined in the EIA Directive (85/337/EEC) as amended in 2011 Directive 2011/92/EU and 2014 Directive 2014/52/EU under Article 6. From the project inception, consultation has been carried out with the public and various stakeholders, the purpose of which was to engage with them, to gather local knowledge on flooding and environmental constraints, and opportunities for addressing flood risk in the area.

3.2 Public Engagement

3.2.1 Comprehensive communication and engagement plans have been developed and adopted by the team such as a project website, direct emails, local media, and public consultation among other approaches.

3.2.2 The first Public Consultation Event (PCE) took place remotely due to the COVID-19 pandemic. It ran from 18th June – 9th July 2020. The objective of the public consultation was to make stakeholders and the public aware of the project, to introduce Ayesa as consulting engineers on the project, to provide early engagement and to get feedback on the flooding, environmental and other issues of concern to them. A Public Consultation Questionnaire was made available at the event and also on the project website. A total of 13 no. submissions were received during the consultation period by email/post.

3.2.3 The second PCE took place 9th August 2022 in person, with the intention of presenting the emerging options for the flood relief scheme and receive public feedback on these. A total of 36 attendees were recorded as having attended the event.

3.2.4 The third PCE was held on the 23rd of January 2025 between 2pm and 7pm in The Hub in Graiguenamanagh. The purpose of the third consultation was to present the preferred option – Option 3 Raised Defences and Storage Area. An attendance of 27 was recorded at this event. Not all attendees chose to record their presence and observation

3.3 Statutory and Non-Statutory Consultation

3.3.1 At the inception of the Project, a letter was sent to 78 statutory and non-statutory consultees including general public stakeholders on 7th July 2020. This letter sought preliminary views on the Proposed Scheme as well as information or environmental data with regards to the scheme area and its surrounding environs. Responses were received from:

- Department of Agriculture, Food and the Marine
- Department of Housing, Local Government and Heritage
- Health and Safety Authority
- Irish Farmers Association (Dublin Region)
- Uisce Éireann
- National Monuments Service
- Local stakeholders

3.3.2 Statutory consultees were issued a letter and a copy of the Scoping Report, requesting that any comments, observations or submission in relation to the scope and level of information to be included in the EIA be made prior to submission. Responses were received from:

- Health and Safety Authority
- Department of Housing, Local Government, and Heritage
- Uisce Éireann
- Office of Public Works
- Department of Agriculture, Food and the Marine

- Department of Housing, Planning and Local Government, c/o the National Parks and Wildlife Service (NPWS)
- Department of Environment, Climate and Communications
- Department of Tourism, Culture, Arts, Gaeltacht, Sport and Media
- Transport Infrastructure Ireland
- Carlow-Kilkenny Environmental Health Service

3.3.3 All comments received from stakeholders have been considered and are addressed where appropriate in the EIAR and were passed onto the design team where amendments to the design were required.

4 Assessment of Effects

4.1 Population and Human Health

4.1.1 This chapter assessed impacts to population and human health, including 1,506 residents of Graiguenamanagh-Tinnahinch, as well as a number of businesses, health centres, and community facilities. Tourism and recreation facilities have also been a key consideration of the scheme given the prominence of the tourism sector to the local economy.

4.1.2 The Proposed Scheme is expected to have the greatest impact to population and human health during the construction phase of the project. These impacts are predicted to be secondary impacts as a result of disruptions to traffic, noise, air quality, water quality, and landscape/visual amenity. These impacts are addressed in their respective chapters of this EIAR. There will be temporary minor impact to residential and visual amenity lasting only the duration of the construction phase (approximately 3 years in total but shorter time period by area).

4.1.3 Road closures are planned at Well Lane, The Dock, the access road to the Boat Club, Graiguenamanagh Quay, Tinnahinch Quay and the Waterway Ireland Access Road, however all closures are not anticipated for longer than 3 months with the exception of the Graiguenamanagh Quay which will be closed for 6 months. Traffic on Graiguenamanagh Bridge will be impacted for the duration of construction works (36-42 months) as it will be one of the main accesses to all works areas. Road and parking closures will also impact upon local businesses such as Waterside Guesthouse, Supervalu, Mick Doyle's and The Globe. These impacts will be localised to the works area but will be more significant when construction occurs during the summer months, which is the busiest time for tourism in Graiguenamanagh-Tinnahinch. Safe pedestrian access will be maintained, however it will likely be fenced and directed through construction areas. This will facilitate continuous access to the Quays and local walking/cycling pathways such as the South Leinster Way and the Barrow Way.

4.1.4 There is also a risk to personnel employed on the site, as with any construction site, however procedures will be put in place by the contractor to mitigate for this.

4.1.5 Mitigation measures are included in the Construction Environmental Management Plan (CEMP), which seek to limit the effects on human beings with regards to traffic, noise, air, dust, access, landscape and visual impact, and amenity. A Traffic Management Plan will

also be prepared by the Contactor. The residual impact of the construction phase is predicted to be temporary/short-term slight-moderate impact.

4.1.6 A total of approximately 31no. residential properties and approximately 53no. commercial properties are estimated to benefit from the Proposed Scheme once operational. The proposed flood defences have been designed to provide for a possible future flood level increases due to climate change. In the long term, in the operational phase, the reduction in flood risk and investment in the public realm will provide a significant positive effect to the 'at risk' properties and infrastructure, and on tourism. Moreover, the operational phase offers the opportunity to protect and promote human health by creating opportunity for recreation and human health through rowing, kayaking, etc.

4.1.7 The Proposed Scheme and associated flood defences are designed to ensure consistency with the existing land use and zoning of the area and are not planned to cause change to any of the recreational facilities currently present in the area. To gain access to the mooring facilities and slipway along the River Barrow during operation, flood gates are to be established in the flood walls along the quays, and arrangements will be put in place for interested parties.

4.1.8 Overall, significant long-term positive impacts in terms of public health and socio-economic benefits with resultant benefits for human health are predicted on the basis of the flood relief scheme.

4.2 Material Assets

4.2.1 This chapter examines the potential impacts of the Proposed Scheme on material assets including roads and traffic, built services, and waste management.

Roads, Traffic and Transportation

4.2.2 The Proposed Scheme is expected to have the greatest impact to roads and traffic during the construction phase of the project. Roads/traffic/transportation construction phase impacts are not anticipated to be concentrated over the entire scheme area for the entire construction duration (36-42 months), rather impacts will be isolated to the individual construction areas for limited time periods. An exception, however, would be those receptors located in proximity to construction compounds. It is likely that these will be maintained throughout the entire construction programme and therefore traffic impacts are likely for the entire duration and will possibly cause a slightly longer-term impact.

4.2.3 The following roads are identified as being subject to potential use during the construction phase, and therefore where traffic associated impacts are assigned.

Table 4-1: Planned Use of Public Roads

Road Name and No.	Locality	Planned Use during Construction
R703/Main Street	Tinnahinch	Access to The Quay/ haulage of construction materials / removal of waste streams.

Road Name and No.	Locality	Planned Use during Construction
R703/Main Street	Tinnahinch	Access to Hotel Street -Site compound, Area haulage of construction materials/ removal of waste streams.
R703/ Main Street/ Tirlán Farmlife Graiguenamanagh	Graiguenamanagh	Tirlán Farmlife Graiguenamanagh - Access to site compound
Saint Mullins Road	Tinnahinch	Access to St Mullins Road Site compound, Area haulage of construction materials/ removal of waste streams.
R703/Main Street/ The Quay	Graiguenamanagh	Access to The Quay/ site compounds, haulage of construction materials / removal of waste streams.
R703 Main Street/ Peg Washington's Lane	Graiguenamanagh	Access to Peg Washington's Lane/ haulage of construction materials / removal of waste streams.
High Street/ Turf Market Junction	Graiguenamanagh	Access to River Duiske and Turf Market haulage of construction materials / removal of waste streams.
Upper Main Street/ R703	Graiguenamanagh	Haulage of construction materials / removal of waste.

4.2.4 Certain construction areas are likely to require closure of single lanes for temporary time periods, to allow road-side activities to be undertaken safely. Areas where this is likely includes:

Table 4-2: Public Road/Access Closures

Area No.	Area Description (Compound No.)	Details of Public Access/Road Closures	Length of Closure to a) vehicles and b) pedestrians
Area 1	Storage Area	Not applicable	Not applicable
Area 2	Well Lane to High Street Bridge	Well Lane	a) 3 months b) 3 months
Area 3	Turf Market	n/a	n/a
Area 4	Turf Market to The Hub	The Dock	a) 3 months b) 0
Area 5	Boat Club	Access road to Boat Club	a) 3 months b) 0
Area 6	Graiguenamanagh Quay	The Quay	a) 6 months b) 0
Area 7	The Dock	The Dock	a) 3 months b) 0
Area 8	The Hub	n/a	n/a
Area 9	Hotel Street	n/a	n/a
Area 10	Tinnahinch Quay	Tinnahinch Quay Waterway Ireland Access Road	a) 3 months b) 0

4.2.5 Pedestrian access will be maintained throughout the scheme area, including to the South Leinster Way and the Barrow Way. The only exception to this is at Well Lane where pedestrian access will be cut for a period of three months, with a reasonable alternative to be provided at Main Street.

4.2.6 There is off-street residential parking at some of the construction areas. If works require closure of these roads, parking will need to be diverted, and alternative spaces provided for those affected. Appropriate construction phasing will be important to limit impact in this regard. Areas where this is a potential include:

Table 4-3: Parking Space Closures

Area No.	Area Description (Compound No.)	Details of Parking Closures	Length of Closure
Area 1	Storage Area	Not applicable.	
Area 2	Well Lane to High Street Bridge	Not applicable.	
Area 3	Turf Market	Not applicable.	
Area 4	Turf Market to The Hub	Loss of all informal parking at The Dock	3 months
Area 5	Boat Club	Loss of all parking whilst access is closed off	3 months
Area 6	Graiguenamanagh Quay	Loss of all parking during works Loss of all parking except for 2no. spaces for Proposed Scheme	6 months Indefinitely
Area 7	The Dock	Loss of all informal parking.	3 months
Area 8	The Hub	Loss of pitches and parking for duration of works	4 months
Area 9	Hotel Street	Not applicable	
Area 10	Tinnahinch Quay	Loss of all parking nearest quay for duration of works	3 months

4.2.7 The existing traffic infrastructure in the town of Graiguenamanagh is constrained by narrow roads and parking provisions along the Quay. During construction, lane closures are highly likely, particularly for those works occurring along the Quays and along Turf Market and along parts of Main Street. Therefore, general movement of traffic through the town will be slower as a result of lane closures or operation of traffic management measures (i.e., stop lights). Further, longer diverted journeys will likely be required to facilitate traffic movement during lane closures. Overall, a negative, moderate impact is assigned. Impacts will be temporary and localised (not encompassing the entire study area) depending on the location of works at any one time.

4.2.8 The closure of parking provisions whilst work is occurring along the Quays is very likely which will most severely impact those residential and commercial properties situated along them, but also visitors to the town. Further, some alterations to the provisions of parking along Turf Market and Main Steet will likely be altered whilst construction works

is ongoing at these locations. Most impact will be felt to those living in these areas. There is a negative, moderate impact assigned, specific to those receptors most affected by this change. Impacts will be temporary, and localised (not encompassing the entire study area) depending on the location of works at any one time.

4.2.9 The operational and maintenance phase will result in infrequent traffic movements for the purposes of maintenance. However, there will be a permanent, moderate impact as a result of changes in the road system and loss of parking at Graiguenamanagh Quay. These changes have been made to accommodate the flood wall and improved public realm facilities along the Quay as part of the landscape and public realm plan established for the Proposed Scheme.

Utilities and Built Services

4.2.10 It is possible that utilities within the works area will require shut down and/or isolation for periods of time to allow construction works to proceed or to allow for relocation. However, it is unlikely utilities will be damaged during the construction process. These impacts will be negative, slight and temporary.

4.2.11 Diversions of utilities will be required at the following locations:

- Area 1 (Storage Area) will require the diversion of ESB poles.
- Area 5 (Boat Club) will require a non-return valve of the foul sewer to be fitted crossing the flood defence line.
- Area 6 (Graiguenamanagh Quay) will result in the removal of the underground telecommunications cables and the diversion of foul rising main from pumping station to the dry side of the wall.
- Area 7 (The Dock) will require the flood defence to be built over the existing foul sewer clashing with wall alignment and a diversion of underground ESB clashing with wall alignment.
- Area 8 (The Hub) will result in the diversion of the private electrical supplies at campervan pitches.

4.2.12 There will be no disruptions to services when the Proposed Scheme is operational.

Waste Management

4.2.13 There will be primarily two types of waste material as a result of excavation and demolition works during construction. These will be soil and concrete. The total quantity of excavated materials from the Proposed Scheme is estimated to be 3,300 m^3, with 1,900 m^3 coming from soil, and 1,400 m^3 waste from concrete. Topsoil, soil, rock and naturally occurring material excavated in the course of construction activities will be reused within the Proposed Scheme where feasible. Where surplus materials are generated which cannot be reused within the scheme or other construction works these will be waste and will be delivered to authorised recovery and disposal facilities. Appropriate waste management mitigation is outlined in the CEMP and Waste Management Plan (WMP).

4.3 Surface Water

4.3.1 This chapter is primarily concerned with impacts to the River Barrow and River Duiske. The River Barrow is considered of Poor Ecological Status, and the River Duiske is Moderate Ecological Status as per the Water Framework Directive. There are also two millraces, a number of bridges and weirs, culverts, and the Tinnahinch Lock Gates in the scheme area. The River Barrow and River Nore SAC occurs within the scheme area and is a significant sensitive receptor. This is further considered in Section 4.5 Biodiversity.

4.3.2 The main risks to the surface water environment during the construction phase is the potential runoff of suspended solids (such as soil and silt) and hydrocarbons to the rivers. This is a particular risk where in-stream works will occur within the River Duiske.

4.3.3 To minimise the potential impacts, mitigation measures have been proposed which recommend best practices for earthworks and concrete works in and around water. Suspended solids in runoff will be managed through consolidating earth works near banks, and through use of settlement ponds or tanks, and by conducting the large part of earthworks during periods of dry weather. Accidents will be prevented through use of spill kits on all machinery, appropriate storage of hazardous materials. In order to further reduce any potential effect of the works on occurring fish species in the area (Brown Trout, Atlantic Salmon), instream works will only be carried out between July and September, inclusive.

4.3.4 Mitigation included in the CEMP outline appropriate measures to protect against impact to surface water. With the implementation of these mitigation measures, the residual impacts is predicted to be imperceptible-moderate/slight.

4.3.5 In order to reduce the impacts to sediment resulting from the operation of the upstream storage area, the river flow will be maintained at the upstream storage area to allow Qmed (or near to it) flow through the dam at all times. This is the largest flood that occurs every 2 years statistically. This will maintain sediment equilibrium within the river channel. Should aggradation occur in the vicinity of the river flow control structures, removal of gravel should be carried out when river level is low. There will be no instream works. The top of the accumulated gravels will be removed leaving the low water channel unaffected. All gravels removed will be made available to Inland Fisheries Ireland (IFI) for use in fisheries enhancement elsewhere in the catchment and will be stored on site for this purpose. It is not anticipated that this maintenance will be required on a regular basis.

4.4 Cultural Heritage

4.4.1 This chapter of the EIAR describes the archaeological, architectural and cultural heritage environment and identifies the likely significant impacts (positive and negative) on this aspect. The proposed works in G-T will occur with the historic town of Graiguenamanagh, and historic settlement of Tinnahinch. The townlands of Graiguenamanagh are within a

Zone of Notification for the Historic Town of Graiguenamanagh and is also an Architectural Conservation Area.

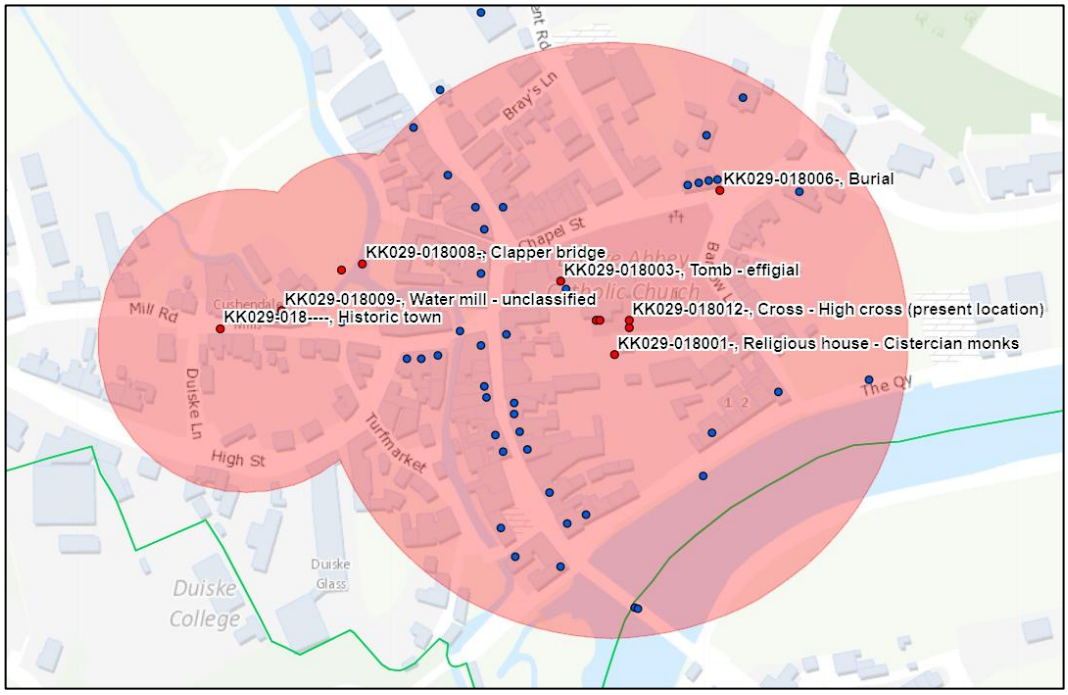

Figure 4-1: Zone of Notification for the Historic Town of Graiguenamanagh as shown on the HEV

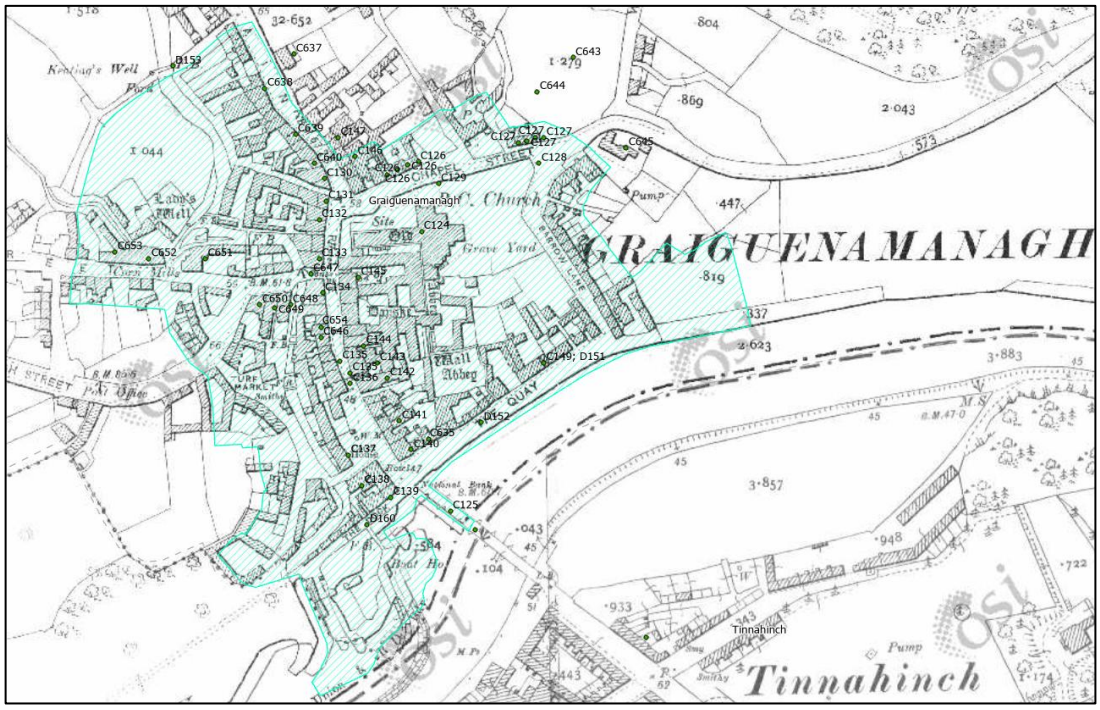

Figure 4-2: Graiguenamanagh ACA

4.4.2 The planned works are taking place close to 10 archaeological sites. There are 27 Protected Structures and 29 NIAH sites (of which 26 are also listed on the Record or Protected Structures), and 27 no. other buildings/structures of architectural/historical interest within or in the immediate vicinity of the proposed works areas. There is one National Monument within Graiguenamanagh, the (Cistercian) Abbey, (Duiske) which is in

the ownership of the State (KK029-018001- 620) but this site is not directly impacted by the works.

4.4.3 There are direct impacts predicted on the following protected structures: the Globe, the Step House, the Anchor, and Dry Dock. Indirect impacts may occur to the following protected structures: High Street Bridge, Market House, Graiguenamanagh Quay, Waterside Guesthouses, 2 no. Houses and a Shop.

4.4.4 Positive impacts are anticipated to Graiguenamanagh Bridge, as it benefits from public realm works. Moreover, positive impacts are anticipated to Graiguenamanagh Historic Town as a result of the flood prevention, improved access and upgrading of public realm works.

4.4.5 A number of mitigation measures will be implemented to preserve the cultural heritage on the site. An archaeologist and conservation engineer will contribute to the construction and reinstatement, and vibration and archaeological monitoring will take place during the construction of the scheme.

4.4.6 Archaeological test excavation is proposed to take place in the following locations:

- Area 7 - Dock Road to assess the below ground potential of the proposed storm drainage infrastructure and pumping station.
- Area 9 – Assess the greenfield environment of Hotel Street/ Tinnahinch Landscape East Zone and the archaeological potential of the lands where a raised embankment and subsurface drainage and pumping station is proposed.
- Area 1 – Upstream storage area, even though the impact is slight, test excavation of the proposed works has the potential to identify small and isolated features of an archaeological nature (if they exist), gather more information about the stratigraphy and soil and to inform the design and construction tender specifications.
- Area 6 – Further assessment of the Graiguenamanagh Quay Public Realm Zone (Duiske Abbey Precinct Area) in the form of wider box trenches in order to reach deeper levels to ascertain if features associated with a precinct wall and abbey or earlier quay side features exist. This work is to be carried out under Ministerial Consent.

4.4.7 Archaeological excavation ensures that the removal of any archaeological soils, features, finds and deposits is systematically and accurately recorded, drawn and photographed, providing a paper and digital archive and adding to the archaeological knowledge of a specified area (i.e., preservation by record). Records will also be kept for buildings and structures of interest.

4.5 Biodiversity

4.5.1 This chapter assessed impacts to potential sensitive receptors within the Proposed Scheme area. These receptors were identified and reviewed through extensive desk-based research and species-specific surveys over a period of four years (2020-2024). A summary of the surveys completed is outlined in Table 4-4:

Table 4-4: Summary of ecological surveys complete

Survey Name	Survey Date
Specialist survey for Bats	14-16/09/2020 & 10-14/06/2024
Habitats and species walkover	June 2020 & 28-29/03/2024
Specialist survey for wintering birds	16-18/02/2021 & 19/12/2023 – 23/02/2024
Specialist survey for Breeding birds	02/04/2021 & 09/09/2023 – 27/06/2024
Specialist surveys for mammals, including otter, badger, pine martin, red squirrel	16-18/02/2021 & 28-29/03/2024
Specialist survey for herpetofauna	16-18/02/2021
Specialist survey for flora	16-18/02/2021 & 26-27/06/2024
Specialist survey for trees	Spring 2021, 23-25/05/2023, Nov/Dec 2023
Specialist survey for alien invasive flora species	16-18/02/2021 & 26-27/06/2024
Specialist survey for Q values/invertebrates	08/02/2021 & 26-27/06/2024
Specialist electrofishing survey	10/02/2021
Specialist Survey for White-Clawed Crayfish (eDNA sampling and testing)	29/04/2021 & 10/08/2023
Specialist Survey for Freshwater Pearl Mussel (eDNA sampling and testing)	30/04/2021

4.5.2 Most notable for the Proposed Scheme is that works will occur adjacent to and within the River Barrow and River Nore Special Area of Conservation (SAC). The Qualifying Interests (QI) for this protected site include Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation [3260], Old sessile oak woods with Ilex and Blechnum in the British Isles [91A0], Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*) [91E0], Brook Lamprey (*Lampetra planeri*) [1096], River Lamprey (*Lampetra fluviatilis*) [1099], Sea Lamprey (*Petromyzon marinus*) [1095], Atlantic Salmon (*Salmo salar*) [1106] and Otter (*Lutra lutra*) [1355]. A full assessment of impacts to the SAC and its QIs have been detailed in the Natura Impact Statement (NIS) prepared as part of this planning application.

4.5.3 Outside of the QIs, the scheme area was identified as being important to a host of flora and fauna, including:

- Mixed habitat, but the most sensitive/notable being oak-birch-holly woodland, riparian woodland, wet-willow-alder-ash woodland, mixed broadleaved woodland, hedgerows/treelines, wet grassland, reed and large sedge swamp and floating river vegetation.
- Thirteen species of tree, with the dominant being Alder, Ash, Willow and Sycamore. Twenty Category A oak trees were identified in the Scheme Area.
- Foraging, commuting and roosting bat species (Soprano Pipistrelles, Daubenton's Bat, Common Pipistrelle and Leisler's bat)
- Twenty-three species of bird including eight that are protected under the Wildlife Acts, five that are listed on BOCCI's Amber List and three that are listed in Annex II and III of the EU Birds Directive.

- Otter, badger, fox and Eurasian Rabbit, with physical signs identified for all.
- Freshwater fish, including brown trout, Atlantic salmon, European eel, twaite shad and at least one of three species of lamprey.
- White-clawed crayfish (suitable habitat noted only).

4.5.4 Significant pre-mitigation impacts of the Proposed Scheme at an international level are possible during the construction and relate to potential disturbance on the Annex 1 habitats and species, and the SAC QIs (as assessed in the NIS). Annex 1 water dependent habitats and species of the SAC could be impacted by the temporary habitat loss to facilitate the river diversion required for construction of Area 1 (upstream storage) and the instream works at Areas 2-4, potential pollution of surface waters caused by runoff from excavated soil and accidental spillage of diesel and oil.

4.5.5 Significant pre-mitigation impacts of the Proposed Scheme that were identified at a national and local scale include:

- Removal of treelines/scrub, hedgerows, wet grassland habitat and dry meadows resulting in habitat loss/disturbance and habitat fragmentation. This has the potential to impact upon the birds and bats that utilise these habitats. Particularly, the removal of linear habitat from the upstream storage area may reduce sheltering habitat for mammals (otter in particular) and roosting/foraging habitat for bats.
- The instream works and river diversion required at construction phase have the potential to result direct and indirect impacts to freshwater fish and their spawning locations, whereby habitat loss and fragmentation, disturbance to the riverbed, and reduction in water quality are all likely.
- The stormwater drainage impacts upon watercourse turbidity during the operation of the Proposed Scheme, but this will occur infrequently, only during large storm events.
- The operation of the flow control structure will not impact upon the movement of fish species, but it does require riverbed reinforcements which will alter the natural riverbed and flow over a short stretch (less than 60m) of the river. This will have direct and indirect impacts to freshwater fish species. It will also provide a barrier to otter along the River Duiske, however they should still be able to traverse the farmland to travel up/down the river.

4.5.6 A series of general (best-practice) and species-specific mitigation measures have been proposed for the protection of surface water, freshwater fish species, birds, mammals, bats, and trees during the construction phase. There are further mitigation measures recommended for noise and vibration, and the prevention of the spread of invasive species.

4.5.7 Pre-construction surveys will be undertaken 3-4 months prior to construction to confirm the baseline conditions and refine environmental mitigation, as required. This will ensure that sufficient updated information is available to inform derogation licence applications, as required.

4.5.8 A host of biodiversity enhancement measures are also included within this chapter as a means of compensating against localised impacts to biodiversity, but also to contribute to Ireland's biodiversity enhancement goals. Some of the measures proposed include bird, bat and bee habitat creation, included as part of the design of the scheme.

4.5.9 It has been found that with the implementation of the proposed mitigation, monitoring and habitat enhancement measures, the Proposed Scheme will not have a significant effect on the integrity of the Natura 2000 site and habitats and species of national and local importance present within the scheme area.

4.6 Landscape and Visual

4.6.1 This chapter examines the potential landscape and visual impacts of the Proposed Scheme on the surrounding areas. The landscape and visual impact assessment examines and evaluates the implications of the proposed works in terms of landscape character and visual alterations arising from the proposed flood defence scheme.

4.6.2 G-T falls within a number of different Landscape Character Areas (LCAs) including the Brandon Hill Uplands, and the Barrow Valley on the Kilkenny side, and Central Lowlands and Narrow River Valley on the Carlow side. There are also a number of protected views and scenic routes relevant to the Study Area. All of these areas and assets can be summarised as highly scenic and sensitive to changes. G-T is also home to protected sites and features of cultural and natural heritage which give the area landscape value. These are discussed in Sections 4.4 and 4.5 respectively.

4.6.3 The landscape and visual impact assessment was informed by a series of photomontages (Appendix 4-3 of the EIAR), designed to represent, as accurately as possible, the physical and visual characteristics of the Proposed Scheme from a variety of distances and directions around the site. Priority was given to views from the public domain, such as main roads and to views from potentially sensitive locations such as from scenic routes.

4.6.4 During the construction phase, a number of trees are to be removed which will impact upon the natural landscape in a number of locations such as at The Hub, The Dock, and less noticeably from a visual perspective, the Upstream Storage Area. There will be further construction impacts due to the presence of construction plant and machinery, temporary construction compounds and works areas. These impacts will only be short-term for the duration of the construction (36-42 months) with grounds to be reinstated or upgraded with new finishes as per landscape design, where appropriate.

4.6.5 During the operational phase, the aspects of the Proposed Scheme which are likely to give rise to landscape and visual impact in the long term are; Changes to road layout along Graiguenamanagh Quay; Height of proposed or amended walls; New structures, lighting, boundaries and pathways; Proposed tree and shrub planting and the measures associated with the flood storage area.

4.6.6 To minimise the visual impacts, the preliminary design of the flood defence included mitigation measures to assist in the successful integration of the Proposed Scheme into the surround townscape. These measures include the materials chosen e.g. stone cladding to walls are intended to be sympathetic to the existing structures; glazed panels proposed

within the flood defence walls and gates in order to reduce the visual impact of the walls where appropriate and to facilitate views towards the river. Further, preliminary design included for public realm proposals, as well as landscape planting, including wildflower meadows and native tree planting. These are further detailed in Appendix 4-2 of the EIAR.

4.6.7 As a result of the considered design and public realm proposals, the impact of the Proposed Scheme upon the Landscape Character and general public amenity ranges from imperceptible to moderate, with impacts lessening as existing vegetation continues to grow and proposed landscaping matures.

4.6.8 For reference, the integration of flood defences and landscape design are outlined in Figure 4-4, Figure 4-5 and Figure 4-6 with the view point location map shown in Figure 4-3.

Figure 4-3: Viewpoint Location Map – Aerial/ Drone Images

Figure 4-4: Drone Visual 1 – Proposed Flooded view at Upstream Storage Area

Figure 4-5: Drone Visual 2 – Proposed defences as seen from Graiguenamanagh looking towards Tinnahinch.

Figure 4-6: Drone Visual 2 – Proposed defences as seen from Tinnahinch looking towards Graiguenamanagh.

4.7 Land, Soils, Geology and Hydrogeology

4.7.1 This chapter assessed impacts to the land, soils and geology in the Proposed Scheme area. The ground investigation works completed to date found that within the townlands of G-T made ground was encountered to depths of up to 1.2-2.0m. Bedrock, peat, native soils and granular soils were also present. Surface cover materials include Bituminous Asphalt. Within the land of the upstream storage area, topsoil with frequent rootlets present in 200-400mm thickness. Made ground, shallow cohesive soils, glacial till and glaciofluvial deposits are also present.

4.7.2 During the construction phase, the main potential impact is the increased risk of contamination to the soils and geological environment. Excavations will also increase the risk of suspended solid and hydrocarbon contamination. Import of fill material has the potential to impact on soil compaction due to frequent truck movements. To minimise the risk to the soils/geological environments a CEMP will be developed by the contractor that will incorporate mitigation measures to manage contamination risks. Measures will include the management of construction material, and hydrocarbons and machinery during the construction phase. The contractor will be required to prepare a Soil Management Programme, ensure imported soils are sourced from a reputable facility, and ensure contaminated soils are sent to a waste licensed soil facility.

4.7.3 The locations of the proposed defences have been defined with consideration of land zoning, with measures implemented to minimise impact where possible. This has been informed by a rigorous consultation programme and continuous coordination with the planning authorities. With regard to land take of the green and recreational parkland areas (The Hub), mitigation during construction will consist of land being set out prior to construction in such a manner to minimise the construction footprint and will be clearly demarcated by fencing. There will be provision of safe accesses and egresses through the area, and provision of information to the general public through signage and notices.

4.8 Air Quality

4.8.1 This chapter examines the impact of the Proposed Scheme on Air Quality within G-T, which is located in the Air Quality Index Region Zone D: 'Rural East', as denoted by the EPA. The nearby monitoring stations at Thomastown and Kilkenny register the air quality as 'good'.

4.8.2 A construction dust assessment has been undertaken to determine whether air quality impacts are likely to arise from the construction of the Proposed Scheme. The risk of impacts from demolition, earthworks, construction and track-out was determined. Subsequently, appropriate mitigation measures have been outlined to reduce the risk of dust soiling, and impact on human health and ecological receptors. These mitigation measures included the requirement for a dust management plan to be prepared, as well as other best practices. Monthly construction dust monitoring, using dust deposition gauges, is proposed at Area 1 and SC B (upstream storage area), and at Area 8 (Hotel Street), at boundaries of the works area/site compound and nearest sensitive receptors to the works (in both cases, residential dwellings). The TA Luft dust deposition limit values of 350 mg/m2/day will be applied as a 30-day average.

4.8.3 Given the nature of the proposed development, it is expected that there will be no air quality and dust impact during the operation and maintenance phase.

4.9 Climate

4.9.1 This chapter assessed the impact of the Proposed Scheme on climate, as well as the vulnerability of the scheme to a changing climate. The Proposed Scheme itself is inherently a climate adaption scheme as climate change is likely to have a significant effect upon flood risk in Ireland due to rising sea levels and more intense rainfall events and storms.

4.9.2 The purpose of the Proposed Scheme is to provide protection to G-T against flooding. As such, the scheme has been designed specific to the 1% AEP present day flood extent and has provided foundations to be adaptable to future climate change scenario. These adaptability measures include:

- The volume of flood storage can be increased to accommodate future increases in flood levels due to climate change.
- On the River Barrow, the wall foundations will be designed to accommodate for future height increases to protect from increased flood levels.

4.9.3 The Proposed Scheme will also contribute to climate change due to increased greenhouse gas emissions during the construction phase. The greatest contribution of GHG emissions during the construction phase will be due to the clearance and demolition and the movement of HGVs to and from the site. Emissions of GHG will also occur as a result of the use of diesel-fuelled generators onsite, and of plant during the construction phase.

4.9.4 The Proposed Scheme will not produce any GHG emissions when in operation other than minor emissions from vehicles utilised to complete minor maintenance and inspection tasks. There will be negligible greenhouse gas emissions from maintenance activities.

4.10 Noise and Vibration

4.10.1 An assessment was carried out of the noise and vibration effects arising from the construction of the Proposed Scheme. The baseline noise environment was determined by conducting surveys at sensitive locations in the vicinity of the Proposed Scheme. The results of these surveys indicate that the current noise levels are dominated by local road traffic noise and city hum created by a combination of commercial and residential noises as would be expected of an urban location. The River Barrow itself is a source of ambient noise, particularly at the location of river weirs or fast flow, as well as sounds from wildlife in the river environs.

4.10.2 Very significant temporary effects to surrounding receptors have been predicted from sheet piling activities, with significant effects typically from concrete breaking, concrete saws, scabbling concrete walls, or demolition. It should be noted, with the exception of sheet piling these noisy activities would not be expected to occur for long durations on consecutive days, e.g., use of concrete breaking and concrete saws is expected in relation to movement of services and would be expected to be brief.

4.10.3 To mitigate the impacts of noise, various strategies will be employed to reduce construction noise. These include noise monitoring during construction. With these strategies, the construction phase will have a slight-significant impact.

4.10.4 Operational noise and vibration emissions will be limited to occasional activation of pumps (following floods) and periodic maintenance. As such, operational noise and vibration effects would be negligible given durations would be brief and rare, and magnitudes would be low.

4.11 Interactions between Environmental Effects

4.11.1 The interactions between environmental effects which are expected to occur are outlined below:

Population/Human Health and Material Assets

4.11.2 Interactions include impacts to the population with regards to the requirement for infrastructure and services, exposure to increase construction congestion, limitations to access of walkways and cycling routes during construction and exposure to improper construction housekeeping (waste management). All are outlined in Chapter 7 'Material Assets' The impact on traffic network will be felt most at the Quay areas with road and parking closures. These impacts will also be experienced within Tinnahinch as Site Compound A, which will serve as the main compound. Residents in this area will be affected for the 36-42 months of construction which is considered a short-term impact as per the EPA Guidelines 2022.

4.11.3 With the adoption of appropriate construction phasing and sequencing, and mitigation measures outlined in Chapter 7 'Material Assets', the significance of impact is reduced.

Population/Human Health and Surface Water

4.11.4 Contamination of water bodies (namely the River Duiske and River Barrow) is possible via construction-related septic waste and hydrocarbons, possible through accidental overflows, mismanagement, equipment faults, and spillage and because G-T has a direct connection to the rivers, impact of this to human health is possible. However, as part of best practice construction, the implementation of mitigation regarding the management of septic facilities and hydrocarbons storage, and the maintenance of plant and equipment will reduce this impact entirely.

Population/Human Health and Cultural Heritage

4.11.5 Impacts on tourism and general amenity with regards to any alterations/impacts to specific Cultural Heritage assets, and the historic character of the towns. The settlement of G-T is renowned for its heritage and tourist attractions which has now evolved the settlement into an attractive tourist destination. Main assets that are nationally and internationally renowned include the Duiske Abbey, Tinnahinch Castle and St. Michael's Well.

Population/Human Health and Landscape/Visual

4.11.6 There will be some impact on visual amenity during construction for residents living close to the scheme particularly those at Turf Market and customers at the Boat Club. In the operation phase, public realm works at the Quays and the Dock will be most noticed locally. The public realm also opens the Quays for pedestrians but still allows the movement and parking of vehicles through the townlands, providing services for the tourism sector.

Population/Human Health and Air Quality

4.11.7 Concerns are largely in regard to the temporary generation of particulate matter (dust) during key construction activities, and how this has potential to cause negative effect to the health and wellbeing of those identified as the closest sensitive residential receptors. This is particularly relevant for those receptors in a higher age bracket (i.e., 60+) or with underlying health conditions (i.e., asthma) where changes to air quality could result in respiratory concerns.

4.11.8 Extensive mitigation including the implementation of a Dust Management Plan (DMP) and a dust monitoring programme, as outlined in Chapter 13 'Air Quality' will reduce human health impacts significantly.

Population/Human Health and Noise/Vibration

4.11.9 Increase in noise pollution during the construction phase (from construction related heavy-goods traffic, haulage, deliveries and collections etc., and construction related activities, namely excavations and earthworks, sheet piling and concrete pouring) has the potential to influence human health. Particularly for those properties located in close proximity to the noise generating activity, the potential for noise related health implications arises (i.e., headache, alteration of sleep, lack of concentration). Very significant to significant effects are predicted as a result of sheet piling works, particularly for those receptors in Areas 3, 4, 5, 6, 7, 8 and 10.

4.11.10 Following implementation of construction noise and vibration mitigation efforts, as outlined in Chapter 15 'Noise and Vibration' some residual temporary impacts are predicted.

Population/Human Health and Climate

4.11.11 Further interactions exist with regards to impact to Climate under the 'do nothing' scenario, whereby continued and worsening flooding will cause further economic and social burden to those communities in the flood risk zone. From the operation phase perspective however, the successful implementation of the Proposed Scheme has significant positive impacts by providing protection against flooding.

Material Assets and Air Quality

4.11.12 The Outward movements of <10 HDV anticipated over unpaved ground in anyone day. On the whole, access roads to the Work Areas are paved, however there are small unpaved stretches of road and where moderate entrainment of dirt might occur. This is particular

at Area 1 (upstream storage area), and Area 8 (Hotel Street). The magnitude of risk is small and therefore does not give rise to significant impacts.

Material Assets and Climate

4.11.13 Further interactions exist with regards to impact to Climate under the 'do nothing' scenario, whereby continued and worsening flooding will cause further damage and economic stress to infrastructure in the flood risk zone. From the operation phase perspective however, the successful implementation of the Proposed Scheme has significant positive impacts by providing protection against flooding.

Material Assets and Noise/Vibration

4.11.14 The movement of HGV's along construction delivery route would likely cause noise and impacts to nearby buildings. An assessment of the impacts from the construction phase of the Proposed Scheme shows that the increases in traffic noise will not give rise to significant impacts.

Surface Water and Cultural Heritage

4.11.15 Archaeological test trenching and excavation form an important part of the mitigation pre-construction, in order to identify any archaeological finds/features. Test-trenching and excavation presents potential for silt-laden run-off to enter the watercourses, particularly during events of rainfall and/or flood. Dewatering of trenches and/or excavations gives further cause for in-river sedimentation, whereby direct pumping from sumps into the river may result in sedimented dewater effluent, if not appropriately monitored.

Surface Water and Biodiversity

4.11.16 The waterbodies in the scheme area offer valuable habitats for a number of significant and protected species, including Qualifying Interests of the River Barrow and River Nore SAC. Impacts on waterbodies will have associated impacts with fish, mammals and vegetation within the rivers. Mitigation measures have been recommended to reduce these impacts, as outlined in Chapter 10 'Biodiversity'.

Surface Water and Land/Soils/Geology/Hydrogeology

4.11.17 Groundwater and aquifer characteristics and activity are largely dictated by geology and overlying soils. Impacts such as soil compaction, water infiltration into soil, and groundwater flow are directly related to both soil and geology, and surface and groundwater.

Surface Water and Climate

4.11.18 Changes in precipitation patterns will result in increased water levels, as well as a higher frequency of intense storms. This was considered at the design stage.

Cultural Heritage and Biodiversity

4.11.19 As also discussed in Section 4.11.15, Archaeological test trenching and excavation form an important part of the mitigation pre-construction, in order to identify any archaeological

finds/features. Test-trenching and excavation presents potential for silt-laden run-off to enter the watercourses, particularly during events of rainfall and/or flood. Dewatering of trenches and/or excavations gives further cause for in-river sedimentation, whereby direct pumping from sumps into the river may result in sedimented dewater effluent, if not appropriately monitored. Increased turbidity can impact upon fisheries and Qualifying Interests (QIs) of the Special Area of Conservation (SAC) of which the River Barrow and Duiske are associated.

Cultural Heritage and Landscape/Visual

4.11.20 Interactions with Landscape and Visual comprise the potential for impacts to setting and visual amenity of cultural heritage receptors. Conservation measures such as the careful choice of material to be used to reflect the existing built heritage environment or introduce a new tone, the use of stone clad walling and flood proofing buildings with traditional materials and mortar to assist in their protection and preservation all seek to preserve and enhance the historic townscape and riverscape of the town.

Cultural Heritage and Climate

4.11.21 An interaction exists with regards to Climate under the 'do nothing' scenario, whereby continued and worsening flooding will cause further damage to those assets in the long-term. From the operation phase perspective however, the successful implementation of the Proposed Scheme has significant positive impacts for cultural heritage assets by providing protection against flooding.

Cultural Heritage and Noise/Vibration

4.11.22 Vibration has the potential to impact upon nearby cultural heritage assets. This will be managed by vibration monitoring where works occur close to protected structures.

Biodiversity and Landscape/Visual

4.11.23 The construction of the scheme requires some tree removal which will impact upon flora and fauna. Native tree and plant species will be planted in the upstream storage area, as well as where public realm works are taking place. Any lighting required during the construction phase will be located sensitively to avoid unnecessary light spill into the surrounding river corridors and into woodlands.

4.11.24 Landscaping proposed as part of the public realm improvements will have biodiversity benefit, providing further foraging, nesting and pollinating potential.

Biodiversity and Land/Soils/Geology/Hydrogeology

4.11.25 A potential effect on the soils and geological environment includes the excavation and removal of made ground and overburden which could potentially increase the sediment loading to the surface water environment and impact to associated aquatic species. Contaminated or imported soil has the potential to run off during the construction phase and have negative impacts on surface water environments and associated biodiversity, or cause spread of invasive species. Appropriate measures outlined in Chapter 12 'Land, Soils, Geology & Hydrogeology' to mitigate.

Biodiversity and Air Quality

4.11.26 The River Barrow and River Nore SAC passes through Graiguenamanagh-Tinnahinch, and the proposed construction works will take place within or adjacent to the SAC throughout the Proposed Scheme. Direct and indirect effects are possible to flora and fauna, including damage to foliage/plants, changes in habitat foraging and ingestion of particulate matter or pollutants by fauna. Therefore, sensitivity of ecological receptors to dust is considered high. Appropriate construction phase mitigation measures have been outlined in Chapter 13 'Air Quality' to ensure that the potential impacts of dust on the SAC will be negligible.

Biodiversity and Noise/Vibration

4.11.27 The construction of the scheme will result in noise and vibration impacts that will have a temporary-short term impact upon birds and otter, amongst other species. Appropriate mitigation measures are outlined in Chapter 10 'Biodiversity'.

Landscape/Visual and Climate

4.11.28 The height of defences have been designed to accommodate rising water levels and a potential increase in flood intensity. The storage option was chosen as this allowed for a reduction in the height of the defences within the townlands and therefore lessened the visual impact.

4.12 Cumulative Effects

4.12.1 Cumulative effects are those that result from incremental changes caused by other past, present or reasonably foreseeable developments together with the proposed development. In some cases, the identified developments are in such an early stage that there is not enough information to accurately predict the cumulative impacts, however these projects were still considered.

4.12.2 The following projects were considered when assessing the potential for cumulative impacts:

- A G-T joint tourism initiative for a hub and proposed pedestrian bridges across the river – the location of these works are unknown currently but will have to consider the flood relief works in their development. There is a potential for impacts to surface water if the construction phases overlaps. However, with the implementation of mitigation measures outlined in 'Chapter 8 – Hydrology – Surface Water', no cumulative impacts are expected from the Proposed Scheme.

- Uisce Éireann has a scheme to upgrade watermains on the St Mullins Road and the Ring Housing Estate – the details of this plan are not yet known but communication is ongoing with Uisce Éireann to ensure there are no cumulative impacts from any interactions of these projects.

- Waterways Ireland intend to repair the Quay Wall at Tinnahinch – the timing of these works are not yet known. Ongoing communication with Waterways Ireland is taking place to ensure there are no cumulative impacts from any interactions of these projects.

4.12.3 There are nine recently lodged planning applications located in close proximity to the Proposed Scheme works. Given the small-scale nature of the proposed works outlined in these planning applications, either no or limited cumulative effects are anticipated.

4.13 Major Accidents and Disasters

4.13.1 This Chapter describes likely significant effects on the environment arising from the vulnerability of the Proposed Scheme to risks of major accidents and/or natural disasters, and the potential for the Proposed Scheme to cause major accidents and/or disasters. The underlying objective of this assessment is to ensure that appropriate precautionary actions are taken for those projects where their vulnerability to major accidents and/or natural disasters may result in significant adverse effects on the environment.

4.13.2 During construction, the scenarios with the highest risk score in terms of a major accident and/or disaster during the construction phase of the Proposed Scheme were identified as being 'Contamination of the groundwater/ surface water', 'Minor flooding (20% AEP) of site/working areas during construction works' and 'Major flooding (1% AEP) of site/working areas during construction works'. All were determined to be low risk scenarios and appropriate mitigation outlined to reduce risk further.

4.13.3 During operation, the risk of 'Failure of the flood defences' and 'Flood event in excess of design flood event, resulting in overtopping of the flood defences' were assigned risk scores of 4 and 6 indicating a scenario that they are 'extremely unlikely' and 'very unlikely' to occur, given that the defences were designed in line with current best international practice, with appropriate health and safety checks in place and that the scheme has been designed to allow adaptation for increase in flows due to climate change.

4.14 Residual Effects

4.14.1 With the effective adoption of mitigation and monitoring measures recommended in the EIAR, the CEMP and its appendices, the majority of predicted negative impacts and effects reduce in severity to 'no impact', 'imperceptible', 'negligible' or slight. However, a number of negative residual impacts of 'moderate' and 'significant' severity remain for the Proposed Scheme, as outlined below:

- The removal of mooring facilities and relocation of boats along both the Graiguenamanagh and Tinnahinch quays during the construction of the Proposed Scheme presents a negative and moderate impact to boat owners and tourism activities in the area. Whilst Waterways Ireland will seek to ensure some mooring is available for the duration of the works, the relocation is still anticipated to cause nuisance. It will be on a short-term basis however, and minimising the closure period will be achieved as much as possible through construction sequencing. This is outlined further in Chapter 6 'Population and Human Health' of the EIAR.

- Uncontrolled siltation / sedimentation into the River Barrow, River Duiske and consequently the River Barrow and River Nore SAC will result in negative, slight to significant residual impacts. The River Barrow and Duiske are afforded a 'Extremely high' importance, on account of the criteria outlined in NRA (2009), given that the areas that will receive direct impacts are within the River Barrow and River Nore SAC.

The magnitude of impact is considered 'significant', as a vast majority of flood defences are located within or directly adjacent to the SAC. The phasing will mean localised impacts are temporary, but the hydrological connection of all the works areas mean some impacts are short-term for the length of the construction period. Mitigation is proposed however where defences are located in-river or directly on the riverbank (e.g. within the River Duiske), some sedimentation is unavoidable. This is outlined in Chapter 8 'Hydrology – Surface Water' of the EIAR.

- The impacts to the landscape will reduce over time as the tree planting and wildflower meadows mature.
- There is a potential for impact upon soil compaction as a result of the construction. This will have a moderate impact on the soils.
- The Noise and Vibration assessment predicted slight to very significant temporary effects to surrounding receptors from sheet piling activities, in particular. Residual impacts will remain for these works, whereby noise limits are likely to exceed 65 - 70dBA (moderate), 70 – 75dBA (significant) and above 75dBA (very significant), even with mitigation present. This is particular for Areas 5, 6, 7 and 10 where receptors are located close to areas where sheet piling is proposed.

4.14.2 The 'do nothing' scenario predicts negative long-term/permanent significant impacts for residents, commercial properties, infrastructure/utilities and human health. Essentially, if the Proposed Scheme were not to proceed, the fluvial flood risk currently present will remain as is, with resulting impacts to 'at risk' properties, commercial facilities and infrastructure.

4.14.3 A full summary of all residual effects is provided in Chapter 18 of the EIAR.

4.15 Schedule of Environmental Commitments

4.15.1 The Schedule of Environmental Commitments outlines the mitigation and monitoring commitments required during the construction and operational phases of the Proposed Scheme. It is outlined in Chapter 18 of the EIAR.

4.15.2 A CEMP has been prepared alongside the EIAR (Appendix 4-4) to provide guidance to the appointed contractor(s), setting out the measures identified in this EIAR as well as general site management best practise. The appointed contractor will be responsible in taking ownership of this document and adapting it into a dedicated and site-specific CEMP to be considered a 'live' document understood and implemented by all construction staff and sub-contractors throughout the construction process.