River Slaney (Enniscorthy) Drainage Scheme

Environmental Impact Statement

The Office of Public Works

February 2009
Final Report
9M9540

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1 INTRODUCTION

1.1 Background

1.1.1 The Office of Public Works (OPW) has undertaken a study of the flooding problem at Enniscorthy, County Wexford. **Figure 1.1** presents the River Slaney and Enniscorthy study area.

1.1.2 Royal Haskoning (formerly Posford Haskoning) were commissioned by the OPW to undertake the Environmental Impact Assessment (EIA) for the proposed study and the resulting preferred scheme. The initial stages entailed the production of an Environmental Constraints Study (Posford Haskoning, 2003) for the OPW, which reviewed the potential environmental impacts of a range of possible flood relief and flood protection options. Subsequently, an Options Report (Posford Haskoning, 2008) was produced which examined in detail a range of options in detail, in order to identify the preferred option on environmental, economic and engineering grounds.

1.1.3 This document presents the culmination of the EIA process, and provides the Environmental Impact Statement (EIS) of the preferred option for the proposed drainage scheme at Enniscorthy.

1.2 Statement of Need

1.2.1 There have been four major floods at Enniscorthy in the 20th century, in 1924, 1947, 1965 and 2000. The 1965 flood was the largest on record and resulted in water levels about 1.25m higher than during the 2000 event. The 2000 flood event damaged approximately 110 properties and caused extensive damage and disruption. The extent of the flooding, within Enniscorthy, is shown in **Figure 1.2**. It was in response to the 2000 flood event that the OPW was requested to carry out the investigation into the flooding problem.

1.3 Requirement for an Environmental Impact Assessment (EIA)

1.3.1 Under the Arterial Drainage (Amendment) Act, 1995, the OPW is required to follow the EIA process and prepare an EIS in order to provide documented information about the potential environmental impacts associated with the flood relief proposals for Enniscorthy. The first stage of the EIA process is to prepare a Constraints Study which examines the issues within the study area upon which any flood relief measures could have an impact (see **Section 1.4**). The second stage is to provide an Options Report which identifies the potential environmental impacts relevant to a range of possible scheme options (detailed in **Section 3.3**). This report, the EIS, is the third stage and provides the detailed information required to accompany the relevant application for the proposed scheme.

1.3.2 The proposed scheme falls under the category 10.f (ii) (project type 12A) (EPA, 2003), which falls under the 2001 EIA Regulations Fifth Schedule Part II. The items noted in the EPA document are presented in **Appendix 1**.

1.4 Constraints and Scoping Report

1.4.1 The Constraints Report (Posford Haskoning, 2003) was produced in September 2003 and submitted to the OPW. The report was based on consultation with statutory consultees, a Public Information Day, and collection of a range of environmental and related data and information. The conclusions of the Constraints Report are presented **Table 1.1**.

Table 1.1 Impacts Raised in the Constraints Report

Parameter / Issues
Protected Species
It will be necessary to undertake specialist surveys of those protected species that are known to be present within the Constraints Study Area. This includes otter and aquatic macrophytes (both short-leaved water-starwort and stream water crowfoot are known to be present). Any aquatic macrophyte survey should preferably take place in August. This additional information will provide much more detailed maps highlighting species distributions and areas that should be avoided.
***Fisheries and Angling* – Both commercial and recreational salmon fisheries on the Slaney have been closed since 2007**
Although this stretch of the river is known to have both salmon and trout spawning, it is not considered to be as important as the more recognised spawning grounds further upstream (ERFB, *pers. comm.,* 2003). Angling is popular in Enniscorthy, particularly downstream of the old bridge and any reduction in fishing access should be avoided. Anglers are also worried about options that would reduce fish numbers within this stretch of the Slaney, such as increased flow rates and the loss of in-river pools. The value of the pleasure fishing market should be quantified in terms of rod licences sold, day tickets sold upstream of the old bridge, club membership, catch data, etc. in order to ascertain the importance of this resource.
Hydrology
Any alteration in flow regime, whether permanent as a result of channel alterations or temporary during in-river work could impact upon fish numbers. A reduction in fish numbers (reduced residence time) will directly impact upon angling (both commercial and recreational) and as a food resource for otters. Flow changes could also exacerbate the navigation problems experienced on the river.
Landscape
The Study Area is surrounded by landscape that is designated as 'vulnerable' and 'sensitive' within the Wexford County Local Plan (Wexford County Council, 2001a) and also contains areas of high visual amenity that the County Council want to ensure are conserved. The impact of walls or other works along stretches of the river may impact upon this conservation policy. There is also the potential to impact upon visual receptors, the character of the landscape (e.g. impact upon sites and monuments), conservation features and socio-economic related values such as angling and tourism.
Cultural Heritage
There are a large number of both Recorded Monuments and Protected Structures throughout the Study Area. There are potential impacts directly to the structures themselves, such as Enniscorthy Bridge, and to the setting of several of them. In order to determine the potential impact upon any of these structures it will be necessary to determine the recognised boundary of these monuments in close liaison with Dúchas and the Department of the Environment.
Local Community
It is important that any proposed scheme is seen to be addressing the concerns of the local community. Whilst a solution to the flooding problem is seen as essential for most residents and interested parties, a minority would rather see the river left alone and therefore alternatives to flood containment should also be considered during cost/benefit analysis.

1.5 EIS Report Structure

1.5.1 This EIS is presented in the group format structure as identified by the EPA (2002). Consequently, the report is divided into 15 sections. **Section 1** provides the background (or preamble) to the report. **Section 2** provides background to flooding, flood alleviation, and flood maintenance activities in the River Slaney particularly with respect to the Enniscorthy area. **Section 3** examines the alternative options considered, and then describes in detail the proposed scheme construction and operation. **Section 4** explains the methodology used in the impact assessment process, describing the consultations undertaken, and the methodology and terminology used to determine the significance of any impacts.

1.5.2 **Sections 5** to **16** detail the existing baseline, do-nothing scenario, potential environmental impacts, mitigation measures, and monitoring for each environmental parameter. The parameters examined are:

- human beings (examining issues relating to recreation, traffic, access, and socio-economics);
- flora (examining issues relating to habitats and specific flora, as well as designated sites);
- fauna (examining issues relating to specific species of fauna);
- soils and geology (examining issues relating to geology, soils and sediment quality);
- water (examining issues relating to hydrology, water quality and water resources);
- air (examining issues related to vehicle emissions during construction and operation, and to dust);
- noise and vibration (examining issues relating to construction noise and vibration, and alteration to the noise environment during operation);
- climate (examining issues relating to emissions of greenhouse gases, local climate variation, and climate change);
- landscape (examining issues relating to visual amenity, landscape character and landscape views);
- material assets (examining issues relating to infrastructure and property);
- cultural heritage (examining issues relating to the historic environment and archaeology); and
- the interaction of the foregoing (examining the interaction between environmental factors and how each influences another).

1.5.3 Finally, **Section 17** summarises the conclusions of the assessment process and highlights the recommendations drawn from the EIA. It also summarises monitoring proposals, liaison and other consultations that should be undertaken as part of the proposed scheme.

1.6 Study Area

1.6.1 The Study Area is the catchment of the River Slaney extending approximately two kilometres upstream of Enniscorthy (Grid Reference 298900 141700) to half a kilometre below Edermine Bridge (Grid Reference 297900 134000). The study area also includes the most downstream half a kilometre section of the Urrin River to its confluence with the River Slaney (refer to **Figure 1.1**).

1.6.2 The River Slaney and surrounding area, including the market town of Enniscorthy, contains a diverse range of land use including the historic town and river itself, agricultural and horticultural land and countryside. The River Slaney is tidal upstream as far as Enniscorthy, with the tidal and freshwater boundary defined, under Section 10 of the Fisheries (Consolidation) Act 1959, as the Old Bridge in Enniscorthy (Eastern Regional Fisheries Board, *pers. comm.,* 2003). However, the river is tidally influenced up to the Railway Bridge, in that the tide can be seen to affect water levels at the water level recorder on the Enniscorthy Bridge (or Old Bridge as it is often called).

1.6.3 Upstream from Enniscorthy the river channel is approximately 75m wide. Downstream of Enniscorthy the river channel is approximately 100m wide but widens to 125m when the flow is tidally constrained. The valley floor of the river is between 300m and 500m wide with the channel flanked by floodplains. Either side of the valley floor, the ground rises steeply from approximately 5m above Ordnance Datum (OD) Malin to between 30m and 50m above OD Malin.

1.7 The Environmental Impact Assessment Team

1.7.1 The EIA process was undertaken, and the EIS prepared, by Royal Haskoning, with additional input from Roger Goodwillie and Associates, and Brady Shipman Martin Landscape Consultants. The Royal Haskoning team included specialists with particular experience in EIA for flood defence schemes, as well as specialists in aquatic and terrestrial ecology, ornithology, noise, air quality, sediment quality, archaeology, and environmental impact assessment. Roger Goodwillie and Associates carried out the Habitat Survey, Callitriche Survey, and the Mammal Survey.

1.8 Acknowledgements

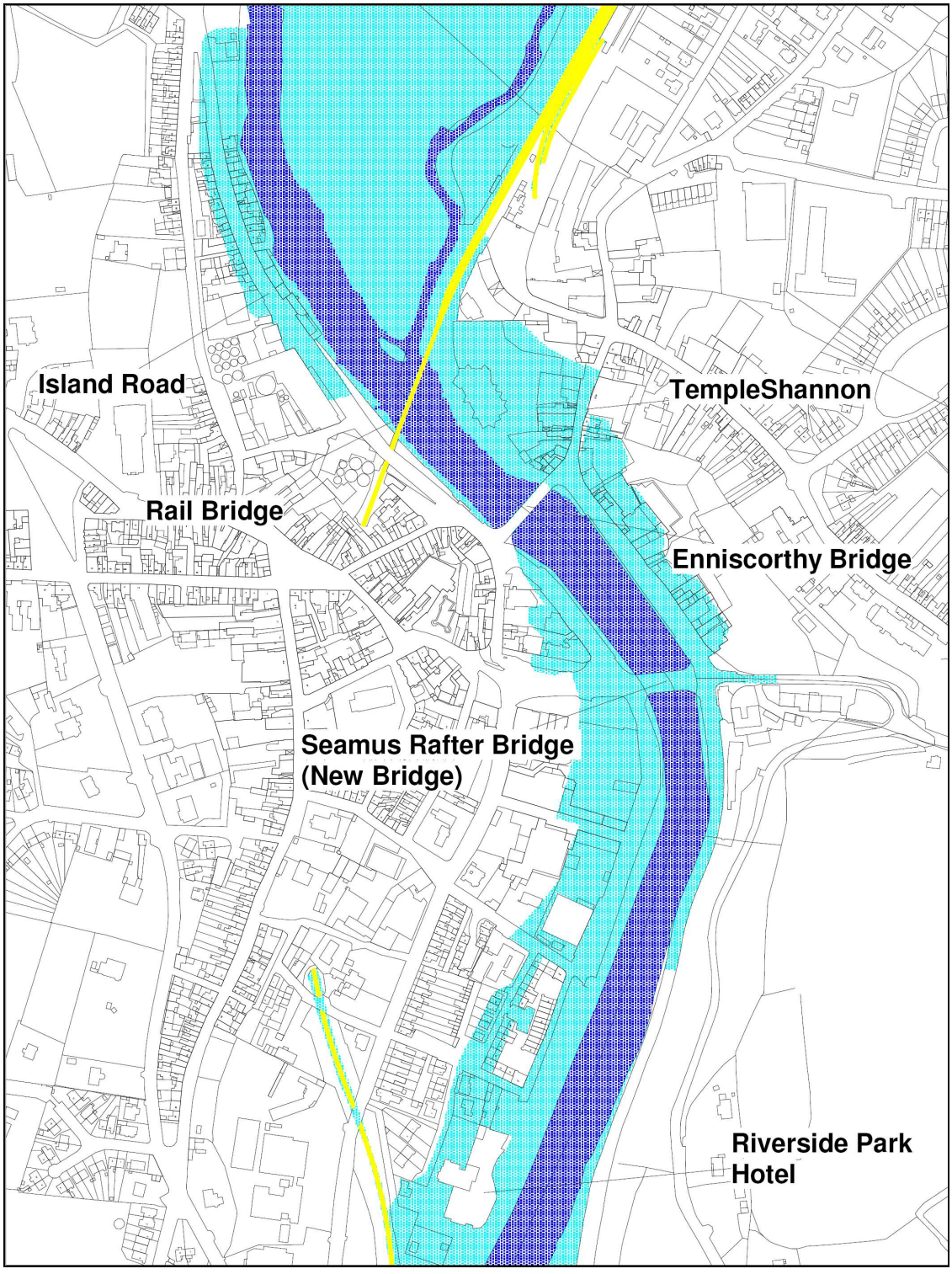
1.8.1 Royal Haskoning would also like to thank the engineering section of the Office of Public Works for their significant contribution to the technical detail in relation to the scheme design and hydrology, Jacobs Ltd for their geomorphological work, the Eastern Regional Fisheries Board for their input in relation to the fisheries within the River Slaney, Mott McDonald Pettit Ltd for their work on the Preliminary Bridge Report, and also the many others who contributed information and opinions with respect to the proposed scheme, not least Wexford County Council, Enniscorthy Town Council, the Slaney River Trust, Ibar Carthy (photographer) and the P.A. Crane Collection, the Enniscorthy Echo, and the staff of the Riverside Park Hotel.

Figure 1.1 Study Area

Key:

Study Area

Figure 1.2 Enniscorthy Town Centre Study Area



2 SITE DESCRIPTION

2.1 Introduction

2.1.1 This section examines the past, present and likely future flood characteristics of the River Slaney with particular focus on Enniscorthy Town and its surroundings, as well as details of the catchment.

2.2 The River Slaney Catchment

2.2.1 About 25km west of Wicklow Town, the River Slaney rises from the western edges of the county, see **Figure 2.1**. Church Mountain and Lugnaquilla provide the small mountain sub-catchments that come together to form the upper reaches of the river that runs through the Glen of Imall. From there, the river flows south for about 25km passing through Baltinglass until it reaches Tullow. Its catchment that lies almost entirely to its east, remains narrow and steeply graded.

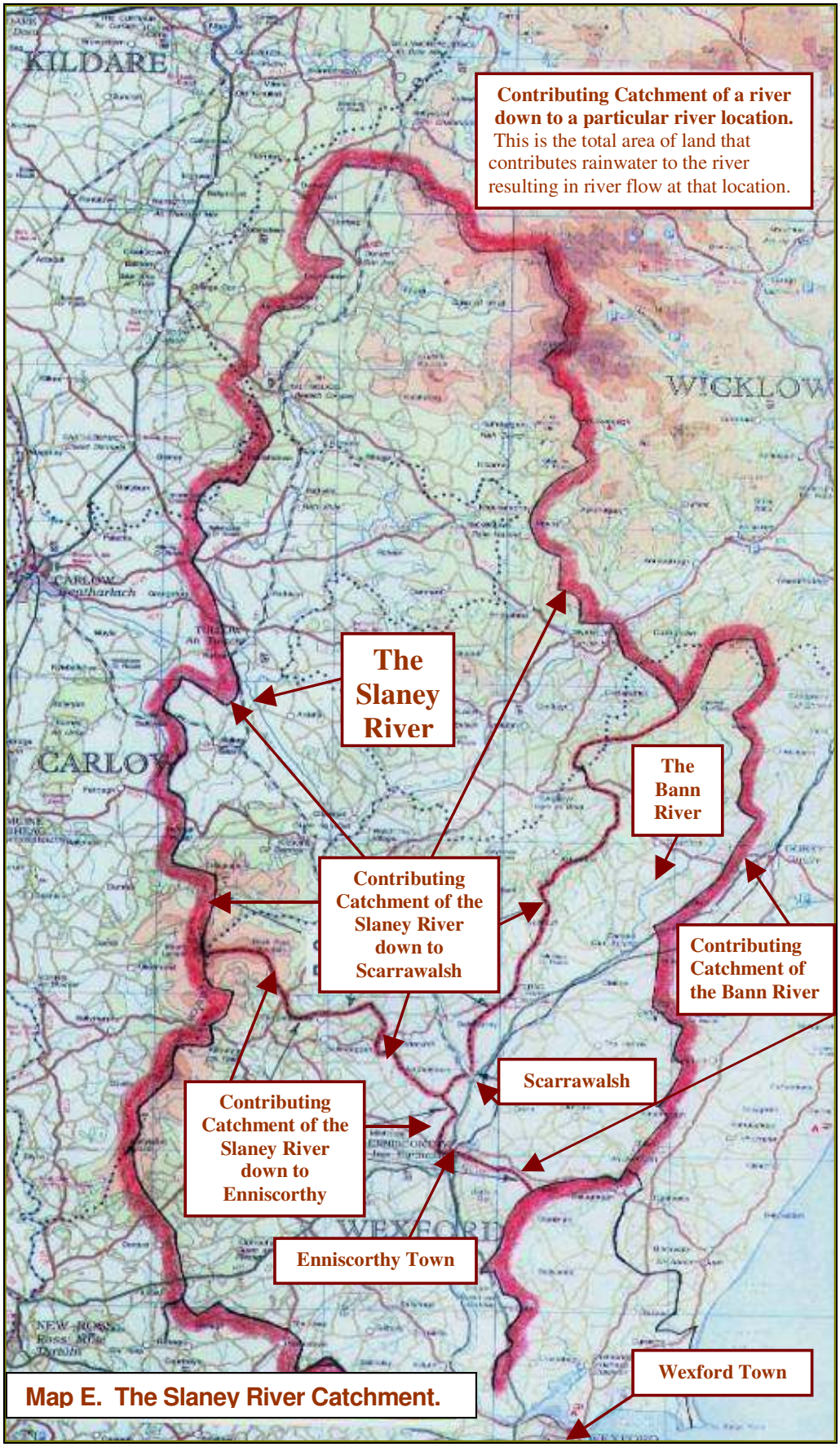
2.2.2 Below Tullow several changes occur. The river alters its course to a south/south east direction and flows the 35km to reach Scarrawalsh where the Wexford Road (N11) crosses it. In that stretch it picks up two large tributaries, namely, the Derreen and Derry Rivers. Downstream of the N11 it picks up the Bann River and two kilometres below this it returns to flowing south. By the time the River Slaney has flowed the remaining 5km to reach Enniscorthy Town, its contributing catchment has grown to 1277 km^2.

2.2.3 The River Slaney confers substantial benefits to Enniscorthy, in particular, it is a natural environment feature that improves the quality of life of the residents within Enniscorthy. However, the river also adversely affects the town by causing substantial flooding that, while infrequent, has resulted in properties being up to three metres deep in water.

2.2.4 The surprising depths of flooding are, in part, due to the lack of floodplains at Enniscorthy. The high ground to its west is part of the foothills of the Blackstairs Mountains (located about 15km away from the town) and the eastern part of the town is partially built on Vinegar Hill. The depth of flooding is also due to the lack of a substantial floodplain throughout most of the catchment. Generally, the floodplains of the River Slaney and its tributaries are not wide and end abruptly in steep sided escarpments and hills; the majority of large Irish rivers do not share this condition. This means that the river only has a small area to flood over, so the flood peak is not attenuated (reduced in size) to the same degree as is common elsewhere in Ireland.

2.2.5 The River Slaney continues flowing due south and one kilometre downstream of Enniscorthy it is joined by the Urrin River, and a further 2.5km on by the Boro River; both these rivers enter from the west and deliver waters from the Blackstairs Mountains. After flowing another 12km the River Slaney turns east and, 5km further on, discharges into Wexford Harbour.

Figure 2.1 The Slaney Catchment



2.3 Historic Flooding

2.3.1 There were four major floods in Enniscorthy Town in the 20th Century, these occurred in 1924, 1947, 1965 and 2000. The 1965 flood was the largest; relative to the November 2000 flood, it produced levels about 1.25m higher upstream of Enniscorthy Bridge and about 0.9m higher downstream of Seamus Rafter Bridge (the new bridge). However, there is insufficient information to establish the hierarchical order of these floods as no systematic survey took place (or such information has not surfaced to date). For the 1924, 1947 and 1965 floods, information is limited to photographic evidence and a number of levels from 1965 that were noted and remembered by property owners.

2.3.2 The one photograph from the 1924 flood (see **Plate 1**) is of the town downstream of Enniscorthy Bridge. This photo shows similar flood levels to those recorded in the photographic evidence from November 2000. These do not refer to peak levels but do suggest that the 1924 event was similar in magnitude and severity to the November 2000 event. It may be possible that the 1924 event was the larger of the two, however, due to changes in the intervening years and insufficient information on the 1924 flood it is not possible to decide the case.

Plate 1 The 1924 Flood - Looking downstream along Shannon Quay

Photograph from the P. A. Crane Collection. Royal Haskoning and the OPW would like to thank Ibar Carthy (photographer), Enniscorthy for the use of the photograph.

2.3.3 From the one photograph of the March 1947 flood (see **Plate 2**), it appears that it is the smallest of the four. Again, in the absence of any other information at this time, it is not possible to comment on the depths reached by the 1947 flood.

2.3.4 This loosely fixes the 1965 flood (see **Plate 3**) at about a 100 Year event and places the November 2000 (see **Plate 4**) and 1924 floods as being between 30 Year and 50 Year events.

Plate 2 The 1947 Flood - Island Road

Photograph from the P. A. Crane Collection. Royal Haskoning and the OPW would like to thank Ibar Carthy (photographer), Enniscorthy for the use of the photograph.

Plate 3 The 1965 Flood – Temple Shannon

Photograph from the P. A. Crane Collection. Royal Haskoning and the OPW would like to thank Ibar Carthy (photographer), Enniscorthy for the use of the photograph.

Plate 4 The 2000 Flood - Upstream of Enniscorthy Bridge

Photograph from 'The Echo', Enniscorthy. Royal Haskoning and the OPW would like to thank 'The Echo' for the use of the photograph.

2.4 The November 2000 Flood Event

2.4.1 The flood event in November 2000 caused considerable damage with around 109 properties flooded, with many over one metre deep in water. The extent of the flood (as understood at present) is presented in **Figure 1.2**.

2.4.2 In many cases properties did not flood from the river adjacent to them, instead, their flooding resulted from waters exiting the river at a point further upstream and flowing overland to them. The following paragraphs provide an account compiled from eyewitness accounts and are presented based on an assessment of the flooding path.

Upstream of the Railway Bridge

2.4.3 During daylight floodwaters reached the level of the track on the Railway Bridge, however, at the flood peak the bridge was under about 0.6m of water. Island Street, on the right (west) bank and north of the railway line, fared badly with 38 properties being flooded with many of these over a metre deep in water. Across the river the floodwaters rose to just under the level of the railway platform and a long stretch of the railway line was flooded.

2.4.4 It should be noted here that if the floodwaters had risen higher than the ground level alongside the railway station then these waters would have continued on downstream and some would only re-enter the river downstream of Enniscorthy Bridge. This would have worsened flooding in the intervening area as these waters have a higher level than the river waters just upstream of Enniscorthy Bridge.

2.4.5 This means that the flooding mechanism is different for the very large floods, such as the flood in 1965 and that in 2000.

From the Railway Bridge to Enniscorthy Bridge

2.4.6 Flooding only took place on the left bank (east side). Once waters entered this area they also flooded properties in Templeshannon leading to a worsened flood condition than might be expected given that Templeshannon is downstream of the bridge and the river level is lower there. In all, about 20 properties and the basements of another two were affected. In addition, the plant room of the swimming pool flooded, however, the public area narrowly missed being flooded; it is about 0.1m above the peak level of the flood.

From Enniscorthy Bridge to Seamus Rafter Bridge

2.4.7 On the right bank (west side), flooding affected all of the new properties along Abbey Quay. These waters then flowed down the road entering the shopping centre (downstream of the new bridge) so that these properties experienced levels about 0.45m higher than the river alongside them. The ground floor of ten properties and the basements of a further four flooded. Flooding was prevented in two more by sealing the doors and by sandbagging.

2.4.8 It has been mentioned that, along the left bank (east side), houses in Temple Shannon were damaged by floodwaters from upstream of Enniscorthy Bridge. Downstream of Temple Shannon, along Shannon Street, about 27 properties experienced flooding (the exact figure is not certain as it has not been possible to gain access to all the properties in this area). However, due to a length of riverside wall collapsing downstream of the new bridge that allowed flooded waters re-enter the river, a measure of relief was brought to these properties on Shannon Quay; the flood survey shows that their flood levels are about 0.3m lower than those experienced across the river in Abbey Quay.

2.4.9 The stream that crosses the N11 and enters at Seamus Rafter Bridge also caused flooding problems. According to accounts, this stream surcharged hours before the River Slaney flooded the town and caused flooding of the Wexford Road (N11).

Downstream of the Seamus Rafter Bridge

2.4.10 On the right bank (west side), starting one hundred metres downstream of Seamus Rafter Bridge eight properties were directly damaged by the adjacent river including the underground car park of the Riverside Park Hotel. On the left bank (east side,) over 300m of the N11 flooded to a depth of up to 1.5m and part of the riverside wall collapsed.

2.5 The 1965 Flood Event

2.5.1 The 1965 flood was larger than the 1947 and 2000 floods. The one photograph of the1924 flood suggests that the 1965 flood was also larger than it; consequently, the information available shows the 1965 flood to be the largest in the 20th Century.

2.5.2 From anecdotal accounts, the 1965 flooding was worsened by debris partially blocking arches of Enniscorthy Bridge, and flood depths in Island Street rose over two metres. The effect of the bridge was to raise upstream levels by about 0.6m; as a result, they were about 1.25m higher than in 2000. This shows that Enniscorthy Bridge was an obstruction to flow in 1965.

2.5.3 In the 1965 flood event, down as far as Seamus Rafter Bridge, floodwater levels were about 0.7m higher than the 2000 flood. Further downstream, 1965 flood water levels were about 0.9m higher than the 2000 flood.

2.5.4 The number of properties damaged in 1965 is not known. However, there have been so many changes in the town that a meaningful comparison cannot be drawn with 2000 flood event. However, using the hydrological model and taking into account the new bridge (Seamus Rafter Bridge), if a flood of similar magnitude occurred today, it is estimated that over 180 properties would be damaged (i.e. about 70 properties more than were damaged in the 2000 flood event).

2.6 Hydrological Modelling

2.6.1 River modelling has been undertaken by the OPW to determine the return periods of past flooding and the levels of future flooding, in order to ascertain what type of flood defence or flood defence options are suitable and appropriate to Enniscorthy. In effect, what will work and what will not.

2.6.2 A numerical (i.e. computer) model of the River Slaney and its catchment has been developed from Edermine Bridge to about 1.5km upstream of the Railway Bridge in Enniscorthy Town. The model has been developed using the numerical hydraulic modelling package HEC-RAS (i.e. the US Army Corps of Engineers' Hydraulic Engineering Center's River Analysis System). This one-dimensional steady flow hydraulic model was used as it is suitable for the conditions in Enniscorthy. A numerical model requires the following information:

- A physical survey of the river, its flood plains and structures; and
- Calibrating information.

2.6.3 The OPW carried out a survey in 2003 of the River Slaney from Edermine Bridge to the upstream extent of Enniscorthy Town (1.2km upstream of the Railway Bridge). Cross-sections were taken approximately every 200 metres throughout the downstream 4km then increased to every 100m and finally every 25m through the town; it also detailed the river structures. An aerial (light detection and ranging; LiDAR) survey of the flood plains was contracted and provides the river survey cross sections across the full length of the floodplain. This data was used to create the numerical model.

2.6.4 The flood levels at Edermine Bridge and throughout the length of the town for both the 1965 and 2000 floods have been used to calibrate the model. In addition, two within-bank profiles have also been recorded and their associated flow measured for use in calibrating the model. While the 1965 flood is estimated to be just greater than the 100-Year event, several intervening changes along the subject river corridor preclude its use as the primary calibrating event. As such, the November 2000 flood is the primary floodplain calibration event.

2.6.5 The OPW have a Hydrometric Station upstream of Enniscorthy Bridge but it was not possible to separate out the fluvial and tidal components to flows, consequently the process as stated in the Flood Studies Research manual of using a nearby catchment was undertaken. The catchment used was that of the Scarrawalsh on the River Slaney, which has an OPW Station a few kilometres upstream of Enniscorthy. The data at Scarrawalsh goes back 53 years. Furthermore, the contributing catchment of the River Slaney down to Scarrawalsh is 1036km^2 and is 1277km^2 to Enniscorthy Bridge (i.e. Scarrawalsh has 81% of the Enniscorthy Bridge catchment).

2.6.6 The peak flow of the 100-Year hydrograph at Enniscorthy, calculated using the 'rainfall-run-off' technique, is 498m^3/s. The estimate of the peak flow for the November 2000 event is 368m^3/s and the 1965 flood peak is 489m^3/s. The calculated return period flows for Enniscorthy are presented in **Table 2.1**. It has been calculated therefore that the 2000 flood has a return period of about 34 years and that the 1965 flood has a return period just under 100 years.

Table 2.1 Return Period Flood Flows for the River Slaney at Enniscorthy

Return Period	Estimated Peak Flows at Enniscorthy
(Years)	(m^3/s)
1	175
2	216
5	258
10	288
25	346
50	409
100	**494**
200	610
250	656
500	832

2.6.7 The OPW's modelling and feasibility study showed that while the tidal component at Enniscorthy is significant, it does not impact on events greater than about the 15-Year. The highest level that shows a tidal effect is 6.2m above OD (Poolbeg) and this is barely perceptible in flood events. Fortunately, this means that tidal effects will not impact on any feasible flood alleviation scheme that protects to the proposed design standard of the 100-year event.

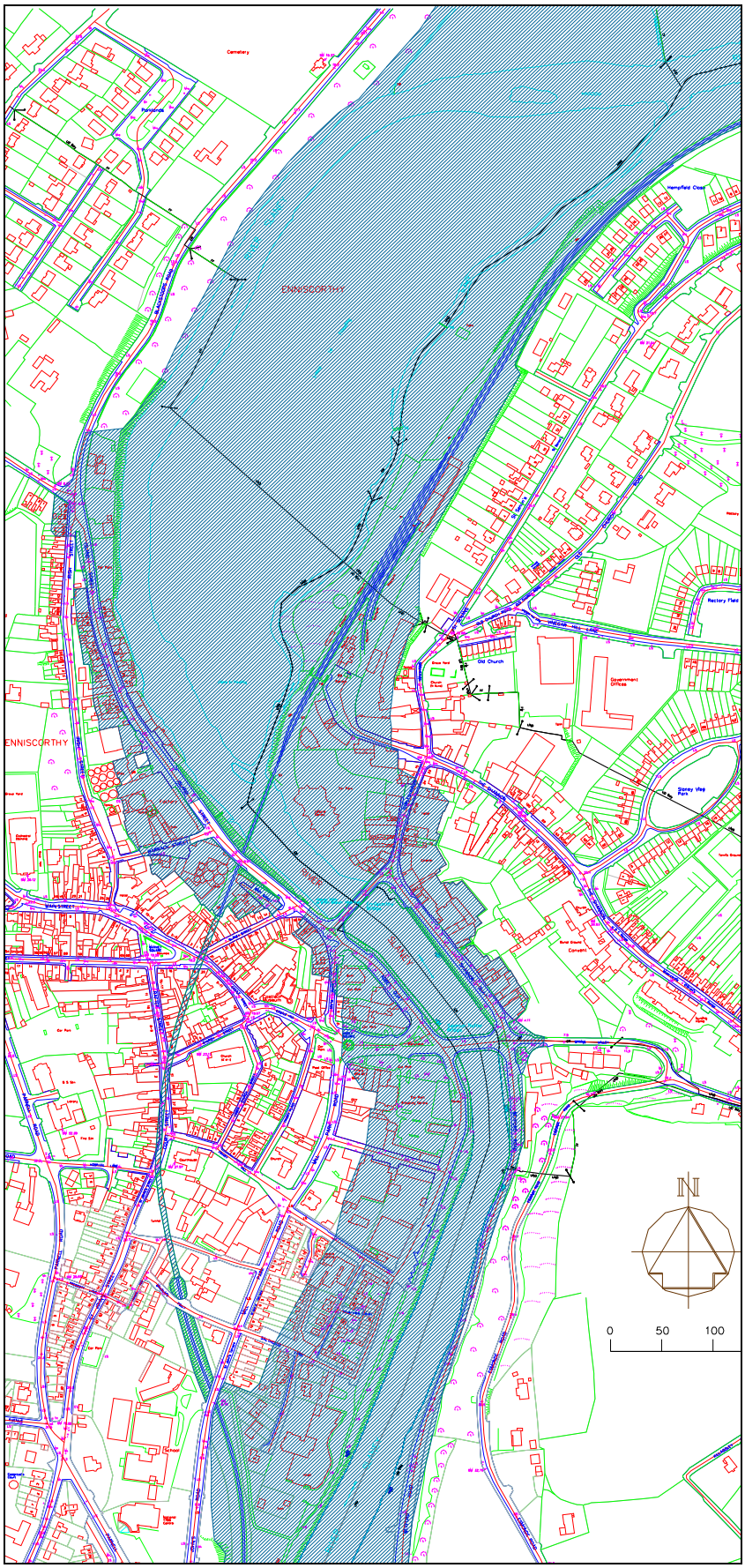
2.6.8 The OPW's work also took account of climate change by taking an estimated 15% expected increase in flood peaks. Although this may not seem like a big change, it is sufficient to increase flood levels within Enniscorthy by between 0.35 and 0.5m, and double the frequency of flooding. Enniscorthy could expect to be flooded every five to seven years compared to about every 15 years at present. While the town does not have a flood alleviation scheme, the effects of climate change are, in part, offset by an increase in the amount of floodwaters that would use the Shannon Quay and Abbey Quay roads as temporary channels. However, the problem becomes particularly acute if a flood alleviation scheme is in place as all the flood water is then within the defences and, additionally, flow velocity changes cause considerable difficulties for future maintenance due to increased erosion, transport and deposition of river gravels. As a result, climate change is a significant factor to be addressed throughout the entire design process. **Table 2.2** shows the updated return event flows taking into account climate change.

2.6.9 **Figure 2.2** presents the calculated flood area for the 2050 (design year incorporating climate change) 100 Year flood event.

Table 2.2 Return Period Flood Flows for the River Slaney at Enniscorthy taking into Account Climate Change

Return Period	Estimated Peak Flows at Enniscorthy
(Years)	(m^3/s)
1	201
2	247
5	295
10	330
25	396
50	467
100	**565**
200	698
250	751
500	952

Figure 2.2 Design Year (2050) 100 Year Flood Event Flood Area



3 THE PROPOSED SCHEME

3.1 Introduction

3.1.1 The OPW intends to provide improved flood alleviation to the town of Enniscorthy in County Wexford. In achieving this, there is a fundamental need to remove and replace the Seamus Rafter Bridge, which is a key asset of the road transport network within Enniscorthy and as such contributes to the national road network. Therefore, the flood alleviation scheme also incorporates the element of construction of a road bridge downstream of Enniscorthy, as well as the other traditional aspects of work such as excavation, construction of embankments, and wall raising.

3.1.2 This section of the EIS describes the proposed scheme. This description is provided in order to ensure that all aspects of the project are considered on environmental, technical and economic grounds. The paragraphs below provide detailed descriptions of the following aspects of the project:

- Alternative options examined;
- Detailed appraisal of technically feasible options;
- Characteristics of the scheme including layout and design components (including their scale), and a description of existing development in the project area; and
- Characteristics of the construction and operation of the proposed flood relief scheme, and any predicted changes.

3.2 Alternatives Examined

3.2.1 The design standard investigated by the Office of Public Works (OPW, 2009) for flood alleviation at Enniscorthy provides protection from flooding up to and including a 1 in 100 year event; there is a 1% chance of a flood of this magnitude, or larger, occurring in every year. This means that, with a scheme in-place, Enniscorthy will flood in the future albeit at a significantly reduced frequency. The Engineering Measures considered by the OPW were:

a) Do Nothing (i.e. implement no new flood alleviation measures);

b) Non-Structural Measures;

   i. Installation of a flood warning system;

   ii. Individual property protection;

c) Relocation of Properties and/or infrastructure;

d) Reconstruction of Properties and/or infrastructure to a higher level;

e) Flow Reduction;

   i. Upstream catchment management (i.e. reduce run-off);

   ii. Upstream flood storage (single site or multiple sites);

f) Flood Containment through Construction of Flood Defences;

   i. Permanent Walls or embankments;

   ii. Demountable Walls (non-permanent walls that may be several metres in height and are capable of being erected within a short period of time);

g) Increase Conveyance (upstream, through and / or downstream of the town);
   i. Remove or reduce local key constraints (e.g. bridges, bends, throttles, infill material on a floodplain, etc.);
   ii. Reduce the roughness of the channel / floodplain (remove vegetation, lining, etc.);
   iii. Specify ongoing channel / floodplain maintenance;
   iv. Change the channel section (re-grade the riverbed by dredging and / or widen the channel by excavation);
   v. Change the floodplain section and / or grade by excavation;

h) Flow Diversion (around or just downstream of the town;
   i. Diversion of entire river;
   ii. Flood flow bypass channel;

i) Sediment Deposition and Possible Sediment Traps;

j) Pump storm waters from behind flood defences; and

k) Measures Specific to the Study Location.

Option a) Do Nothing

3.2.2 The cost of the 'Do Nothing' decision is the net present value of the flood damages that would be expected over the specified project time-horizon (50 years), if no scheme were to be implemented. This has been estimated at €43.4 Million (M). Furthermore, there are the respective health and safety, and social impacts arising from doing nothing.

Option b) Non-structural measures

3.2.3 A flood warning is not issued in relation to the peak of a flood rather it is issued in relation to the onset of flooding. At Enniscorthy, large floods on the River Slaney take about 18 to 24 hours to produce their peak, however, flooding starts many hours ahead of the peak. For example, in November 2000, flooding from the river was already severe enough to stop traffic in the night (at 01:00) yet the flood peaked at 18.45 on the following evening (i.e. significant flooding was occurring 18 hours ahead of the peak). Under present-day unprotected conditions, a flood warning system would need to provide, at least, a 6-hour forecast to the Local Authority and/or Emergency Services. The tight amount of available time makes it very difficult, but not impossible, to provide such a service.

3.2.4 The protection of properties on an individual basis by erecting barriers at doors, windows and air-vents, etc., can be a viable option for reducing flood damages where flood levels rise slowly and reach levels not significantly greater than 1.5m above floor levels. The River Slaney's flood levels, however, rise quickly and extreme events at some locations can be metres above low-lying floor levels. Retaining these heights of water by domestic walls is not feasible on structural grounds.

Option c) Relocation of properties and/or infrastructure

3.2.5 Relocation of residents and commercial properties can be a viable option for reducing flood damages. It is, however, generally viable in rural areas with a low-density of residential or commercial properties, or in urban areas with extreme flood risk and/or no technically, economically or environmentally viable engineering solution. The relocation of all properties within low-lying areas would be extremely costly financially, though, and would

also incur additional environmental and social costs, such as impact to habitat from new construction.

Option d) Reconstruction of properties and/or infrastructure to a higher level

3.2.6 It may be more cost effective to demolish some properties and reconstruct to a higher level in the same location than defend them as presently constructed. This option avoids the additional environmental and social costs, and increased intangible costs, often associated with relocation. For a small number of properties this may be cost-effective, but with a large number of properties as in the case of Enniscorthy it would be very costly to rebuild all properties.

Option e) Flood reduction

3.2.7 For a complete flood relief scheme for Enniscorthy, a minimum storage estimate can be found by assuming the 100-Year Design Flood to be free from significant preceding and following floods (i.e. a clean peak). The Flood Studies Report (FSR) Unit Hydrograph methods have been applied and an estimate made of the hydrograph for the 100-Year design flood. The total volume in excess of the 15-Year flood (the maximum safe flow in Enniscorthy) has been calculated as 6.66Mm^3 so it is necessary to store this volume for a complete flood relief scheme for the town (and, as stated, this is a minimum estimate). In addition, this value would rise by about 80% to 12Mm^3 under the 2050 Climate Change scenario. Upstream of the town, the Slaney catchment with its high-gradient, narrow floodplains (and long flood durations) does not lend itself to this type of solution (or partial solution). No suitable area (or a sufficient number of sub areas) has been found for storing this volume of water. The following paragraph describes the flood storage available at one of the most appropriate locations upstream of Enniscorthy, at Scarrawalsh.

3.2.8 An in-line storage area north of Scarrawalsh Bridge would need a 315m long impounding embankment (dam) across the downstream floodplain and, by including a 0.5m freeboard, its height would be just over 5m above ground level. The permanent loss to agriculture (under the embankment) would be 2.2ha (5.5 acres). This In-line solution would hold back 1.17Mm^3 of flood water, but only 0.34Mm^3 of this represents additional storage (i.e. additional to the natural storage that the floodplain currently provides). This volume amounts to 5.15% of the complete upstream storage requirement so, averaging up, it would take 19.4 equivalent areas totalling 1,035ha (2,557 acres) to be set aside for flooding and need about 2.15 km of embankments with a permanent loss to agriculture (in embankment footprints) of 14.7ha (36 acres). These areas are just not available on the River Slaney and River Bann floodplains. Even using the Scarrawalsh area alone would be ineffective.

Option f) Flood containment through construction of flood defences

3.2.9 A commonly considered option in flood relief is to contain floodwaters within a designated floodable area through the use of floodwalls or embankments. At present, floodwaters utilise the riverside roads and this results in lower flood levels. Shutting off these temporary flow paths by constructing walls (permanent or demountable) would force all floodwater to remain within the river boundary. For this engineering measure, it would also be necessary to raise the parapet level of Enniscorthy Bridge and undertake significant works at Seamus Rafter Bridge. Flood walls would also be required throughout much of the town. The use of containment may also affect flood flows, as well as the erosion and deposition regime. However, containment is a technically feasible option and is looked into in more detail later.

Option g) Increase conveyance

3.2.10 Local obstructions to flow (such as bridges under flood containment solutions, natural rock weirs or restricted sections) can constrict the flow in the river (or floodplain), increasing levels upstream. Removal of, or alterations to, such obstructions can often provide a complete (or partial) reduction in flood levels. Though there is no single option that would provide a suitable scheme, the combined effects of a number of these measures could form part of a possible Flood Relief Scheme.

3.2.11 River excavation measures comprise either re-grading the riverbed by dredging or widening the channel. These measures increase conveyance capacity (i.e., permit the river to carry a greater flow for a given water level). Rehabilitation works (planting, landscaping, etc.) would form part of any excavation work. River excavation measures are a catchall that takes a global approach to individual measures by establishing policies for both riverbed level and gradient along with channel widening. As with local measures they may not provide a complete flood relief scheme, but in combination with other actions, where appropriate, they may form part of a possible Flood Relief Scheme.

Option h) Flow diversion

3.2.12 Diverting floodwaters away from the affected area can mitigate a flooding problem. This can be achieved by excavating a new channel as either a re-alignment of the existing river (a full river diversion), or as an additional relief channel designed only to carry excess flood flows. In the case of Enniscorthy, therefore, these solutions must deal with either the full 100-Year flow of 494m^3/s, or the difference of about 170m^3/s between the 100-Year and the 15-Year peak flow of 330m^3/s (i.e. the maximum safe flow that will pass without flooding the town). Rehabilitation (i.e. environmental integration and aesthetic works) would form part of such a solution. A minimum diversion length of two kilometres would be required to bypass the at-risk urban area. On both sides of the river, the ground level is very high throughout the full length of the town, and this would therefore require excavation depths in the order of 25m or more. In addition, much of this would through rock. The combination of these conditions completely precludes, on physical impact and economic grounds, the construction of any form of diversion option that could allow flood flows to bypass the town.

3.2.13 In specific reaches, there is the possibility that a diversion channel can be constructed which would result in reduced impact to a length of river particularly during construction. As with local measures and increased conveyance, diversion may not provide a complete flood relief scheme, but in combination with other actions, where appropriate, it could form part of a possible Flood Relief Scheme.

Option i) Sediment deposition and possible sediment traps

3.2.14 River gravel is a feature of the River Slaney and this would need to be taken into account in the design of a flood alleviation scheme. Deposited gravel could cause a significant decrease in the protection afforded by a scheme and possibly lead to failure and flooding in the town. Though not forming a separate option, this activity of controlling deposition could form a vital part of a Flood Relief Scheme.

Option j) Pump storm waters from behind flood defences

3.2.15 Storm water may build up behind flood defences, once a flood relief scheme is in place and a significant flood is in progress, due to its inability to discharge into the river. At Enniscorthy, significant floods maintain high water levels for one to two days. It would, therefore, be necessary to cater for the storm water that would otherwise flood out within

the protected area. Though not forming a separate option, this activity of managing culverts and storm water flooding could form an important part of a Flood Relief Scheme.

Option k) Measures specific to the study location

3.2.16 Various indirect measures may arise during the development of a flood relief scheme, often to provide a solution to environmental or social impacts that would otherwise occur. For example, raising road levels to minimise the impact of the height of walls or embankments is a location specific measure. These will be described within the preferred option details.

Summary

3.2.17 Of the 11 key measures to provide flood relief to Enniscorthy, the OPW determined that there is one key feasible option (Option *e) flood containment*) that could potentially benefit from other options which although unacceptable as standalone options would contribute to lowering water levels throughout Enniscorthy, and hence reducing the level of wall heights required for flood defence purposes. The other options that would form part of the technically feasible options that were examined in much more detail in **Section 3.3** are:

g) Increase conveyance;

h) Flow diversion;

i) Sediment deposition and possible sediment traps;

j) Pump storm waters from behind flood defences; and

k) Measures specific to the study location.

3.3 Detailed Appraisal of Technically Feasible Options

3.3.1 The following Engineering Measures were examined in detail to provide the basis for preferred design option for the flood relief scheme. Three possible options have been identified and these, along with leaving the situation unaltered (i.e. without a flood relief scheme) comprise the four alternative options appraised in detail for their potential effects on the environment. These options are:

- **Option A** – Do Nothing;
- **Option B** – Flood Walls (Demountable);
- **Option C** – Flood Walls, Local Alleviation Measures and Limited Dredging; and
- **Option D** – Flood Walls, Local Alleviation Measures and Dredging.

3.3.2 The OPW also identified options from the viewpoints of their functionality (i.e. ability to relieve flooding to the stated standard of protection), technical integration (i.e. issues such as Health and Safety and sediment erosion, transportation and deposition), and economic viability.

3.3.3 Present conditions in the southeast of Ireland would be significantly impacted if the expected 2050 Climate Change Scenario actually occurs. The frequency of flooding within Enniscorthy will increase from about once in 15 years to once in 7 years (i.e. from an expected three to seven events in a 50-year period). There would also be an increased likelihood of very severe events. This implies a corresponding increase in both the frequency and magnitude of extreme flow velocities both within the river and along the

floodplain. Whilst Climate Change does not suddenly stop in 2050, this project only needs to consider the effect up to that date.

3.3.4 The OPW have examined the ease with which scheme options can be altered in the future to accommodate the expected 2050 Climate Change Scenario (should it occur) and this forms part of the decision making process that goes into finding a suitable design solution.

3.3.5 "Natural Failure" is the term applied to the future case where an extreme flood, greater than the design flood, occurs resulting in flooding of the post-scheme town. The degree of flooding depends on the particular constructed scheme (i.e. some schemes produce more flooding than others when "Natural Failure" occurs). This effect provides a significant means of appraising the relative merits of scheme options and helps find the preferred solution.

3.3.6 One of the key causes of flooding within Enniscorthy is the low level of the Seamus Rafter Bridge, which reduces the river cross-section in the centre of Enniscorthy. Removing or ameliorating this cause is a critical aspect of all options.

Option A – Do Nothing

3.3.7 The Do Nothing Scenario was examined to provide a context for the proposed flood relief options. This entailed no changes to the present situation (i.e. no measures such as flood defence structures or channel alterations). Therefore, the current standard of flood protection within Enniscorthy is not altered. At present, flooding may be expected, on average, every 15 years, though with Climate Change this becomes every 7 years.

Option B – Flood Walls (Demountable)

3.3.8 Demountable walls are non-permanent walls that may be several metres in height and are capable of being erected within a short period of time. These require that sufficient space is available for the requisite machinery to both gain access and construct these temporary walls, and also the development of a Flood Forecasting and Warning System.

3.3.9 At present floodwater utilises the riverside roads and this results in lower flood levels. The construction of walls would shut off these temporary flow paths and force the water to remain within the river boundary and this would result in an increase in floodwater levels of about 1m.

3.3.10 The Enniscorthy Bridge parapets need to be raised and the railings on Seamus Rafter Bridge replaced with new parapet walls. Permanent walls could be constructed downstream of Seamus Rafter Bridge, however, upstream flood defence heights are substantial and only a demountable wall would be suitable under this option. Defence heights were calculated along with the additional height that would be necessary should the expected change in climate occur.

3.3.11 **Figure 3.1** indicates the location of both permanent and demountable defences throughout the study area for Option B.

Option C – Flood Walls, Local Alleviation Measures and Limited Dredging

3.3.12 Option C incorporated river excavation (widening and re-grading by dredging) in the 1.25km river stretch downstream of the town (i.e. downstream of Riverside Park Hotel) to increase the conveyance capacity of the river (i.e. this permits it to carry a greater flow for a given water level). Rehabilitation works (planting, landscaping, etc.) formed part of these excavation measures.

3.3.13 This option also involved removal or alteration of specific localised obstructions, including:

- Changes to the left (east) bank of the river at the railway and Enniscorthy Bridges;
- Removal and reconstruction of Seamus Rafter Bridge (to a new location); and
- Lowering the riverbed to 'design grade' under both Enniscorthy Bridge and the railway bridge (by 1.2m and 1m respectively). These works include underpinning of the bridges themselves and appropriate incorporation of fish passes, if necessary.

3.3.14 The river bed would be lowered to 'design grade' under both Enniscorthy Bridge and the rail bridge (lowering by 1.2m and 1m respectively). These works will include underpinning of the bridges themselves and appropriate incorporation of fish passes.

3.3.15 **Figure 3.2a** indicates the defence measures required within Enniscorthy Town and **Figure 3.2b** indicates the defence measures required downstream of Enniscorthy under Option C. With an increased conveyance capacity, permanent flood relief methods such as floodwalls would be at a lower height than for Option B.

Option D – Flood Walls, Local Alleviation Measures and Dredging

3.3.16 Option D resulted in the lowest wall heights as it involved the largest amount of river excavation and therefore greatest conveyance capacity of the river. **Figure 3.3a** indicates the extent and heights of floodwalls / embankments required throughout the study area. River excavation measures comprise either re-grading the riverbed by dredging or widening the channel to increase the flow capacity of the river. Option D also incorporated rehabilitation works such as planting and landscaping.

3.3.17 River excavation (widening and re-grading by dredging) would take place from 1.25km downstream of the town (i.e. downstream of Riverside Park Hotel) up to, approximately, 1.25km upstream of the railway bridge. It could also include the possible diversion of flood water to replace some river widening. River widening would take place in 6 locations:

- Downstream of Seamus Rafter Bridge (**Figure 3.3a**);
- Downstream of Enniscorthy Bridge (**Figure 3.3a**);
- Between Enniscorthy Bridge and the railway bridge (**Figure 3.3a**);
- Downstream of the town (**Figure 3.3b**);
- Upstream of the railway bridge (**Figure 3.3c**); and
- 1km upstream of the town (**Figure 3.3c**).

3.3.18 In addition, Option D included the removal or alteration of localised obstructions including (see **Figure 3.3a**):

- Changes to the left (east) bank between the Railway Bridge and Enniscorthy Bridge;
- Removal and reconstruction of Seamus Rafter Bridge (to a new location); and
- Lowering the riverbed to 'design grade' under both Enniscorthy Bridge and the railway bridge (by 1.2m and 1m respectively). These works include underpinning of the bridges themselves and appropriate incorporation of fish passes, if necessary.

Figure 3.1 Option B - Flood Walls (Demountable)

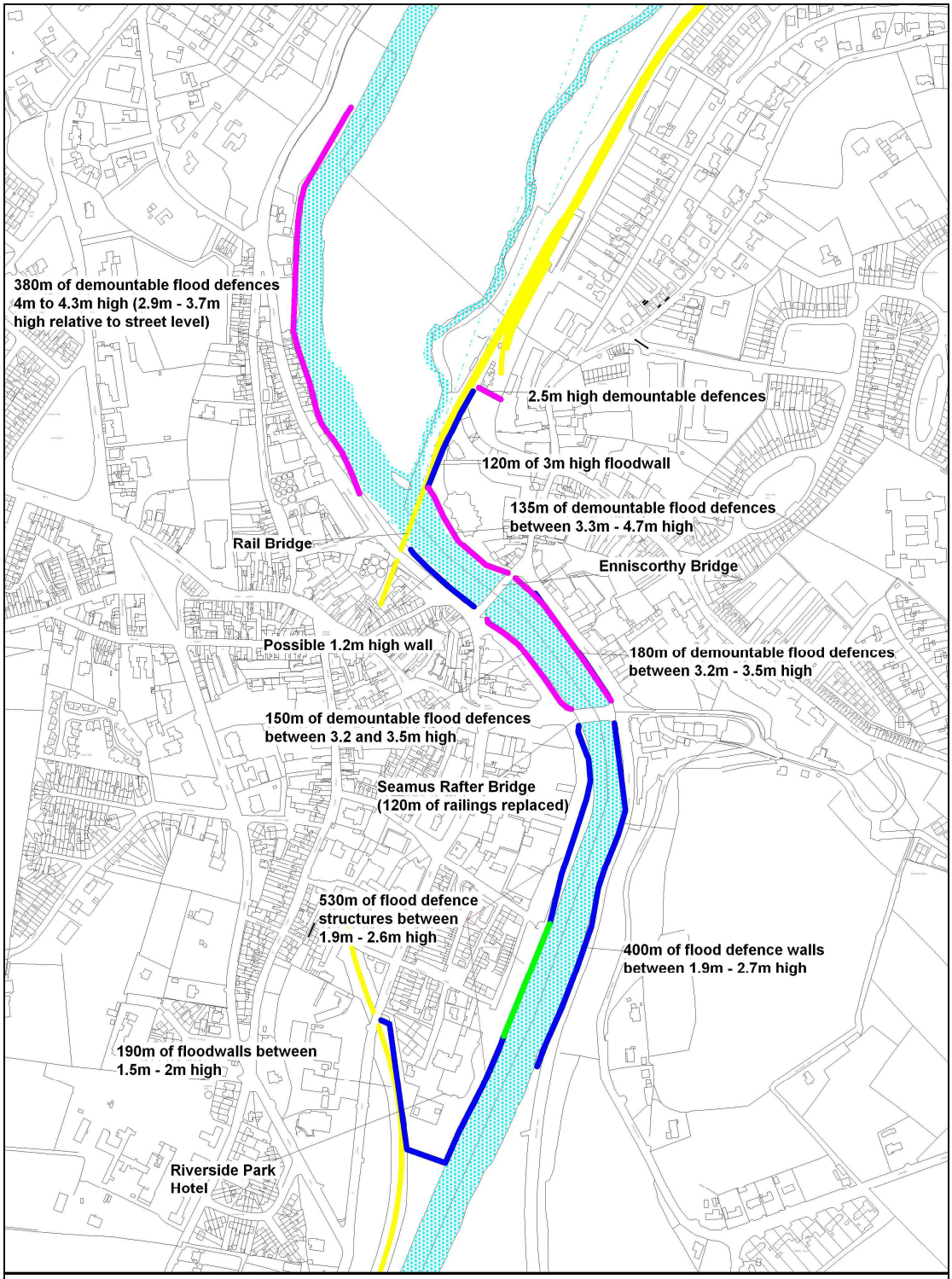


Figure 3.2a Option C – Flood Walls, Local Alleviation Measures and Limited Dredging within the Town

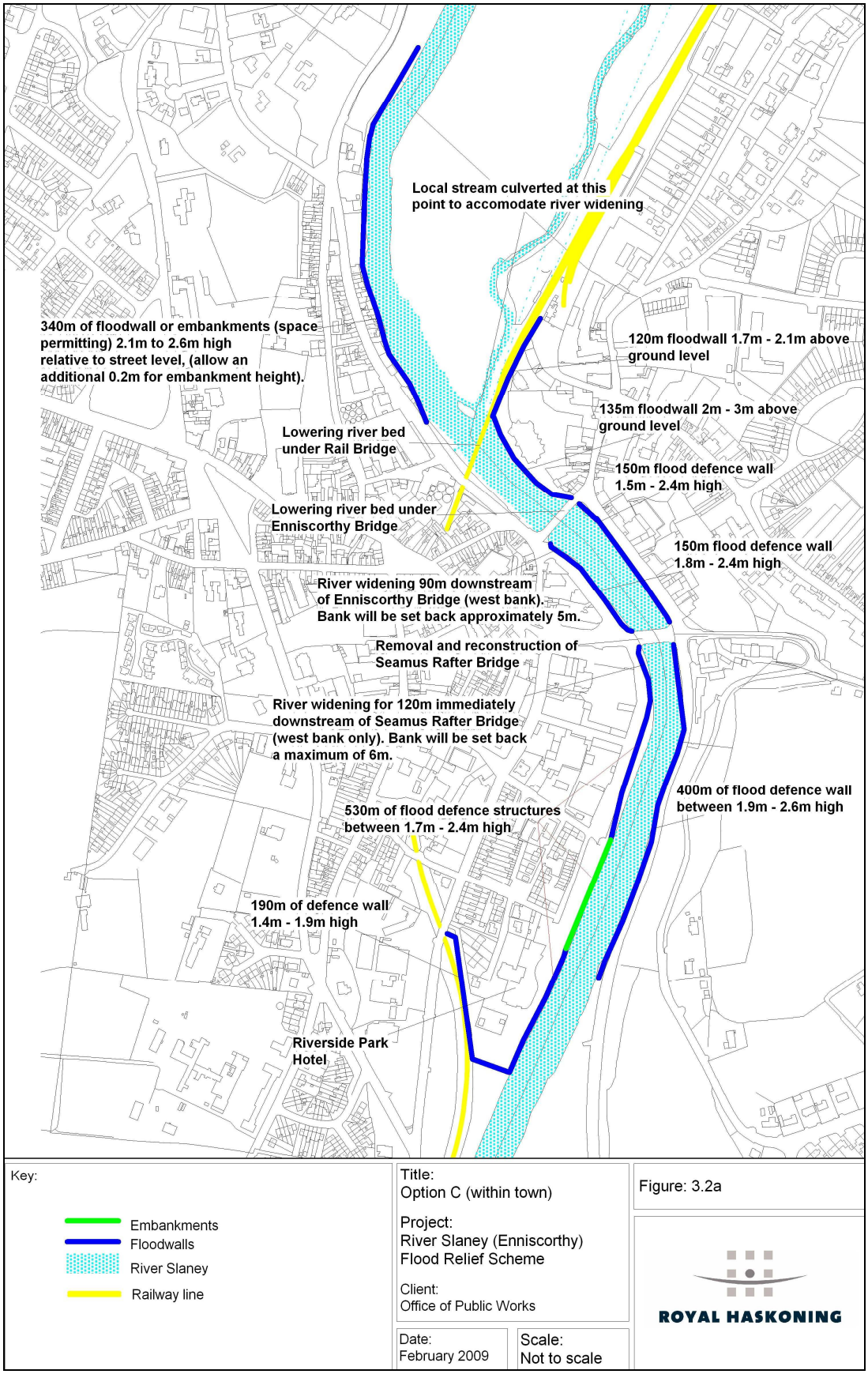


Figure 3.2b Option C – Flood Walls, Local Alleviation Measures and Limited Dredging downstream of the Town

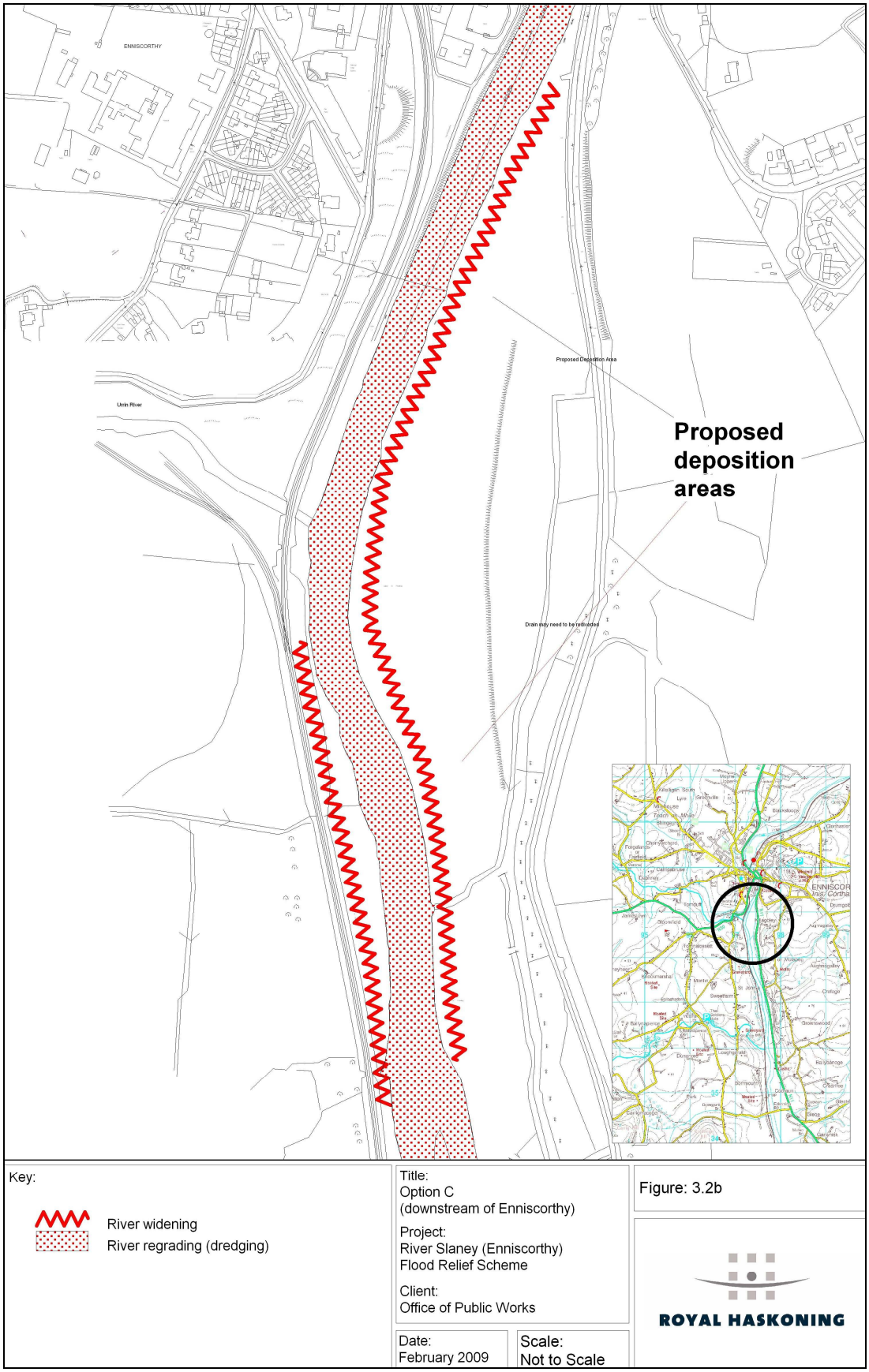


Figure 3.3a Option D – Flood Walls, Local Alleviation Measures and Dredging within the Town

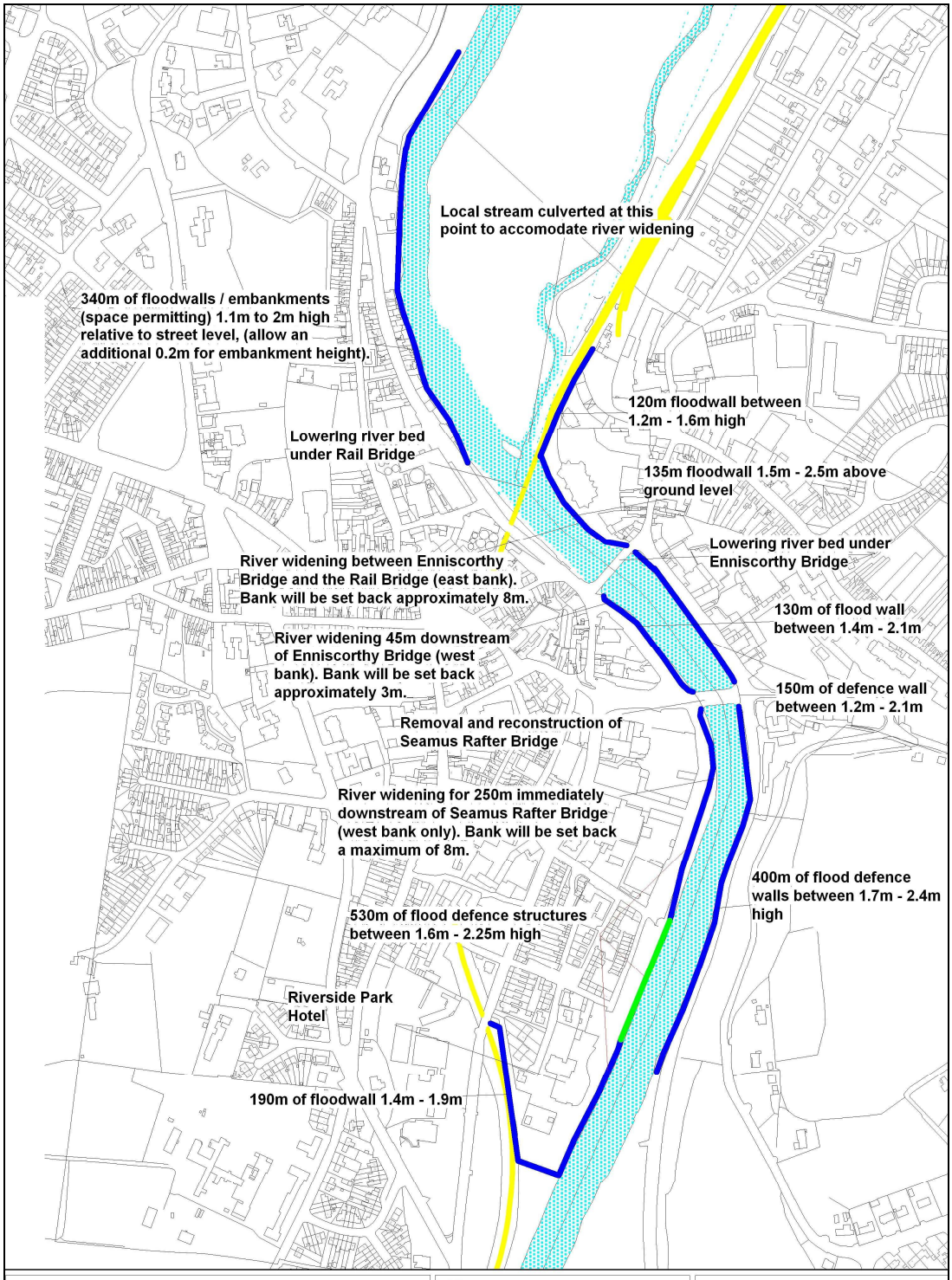


Figure 3.3b Option D River Widening Dowstream of the Town

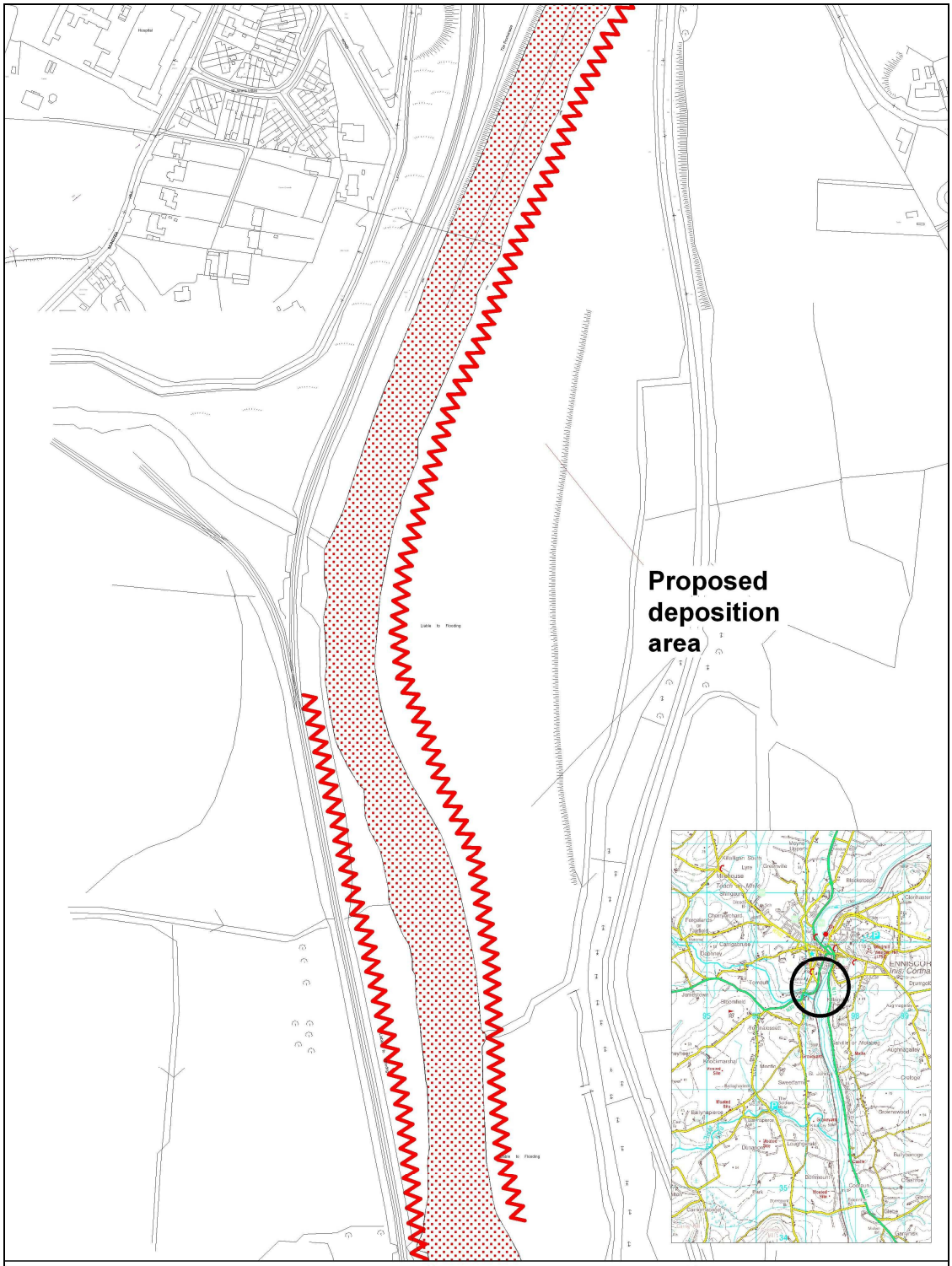
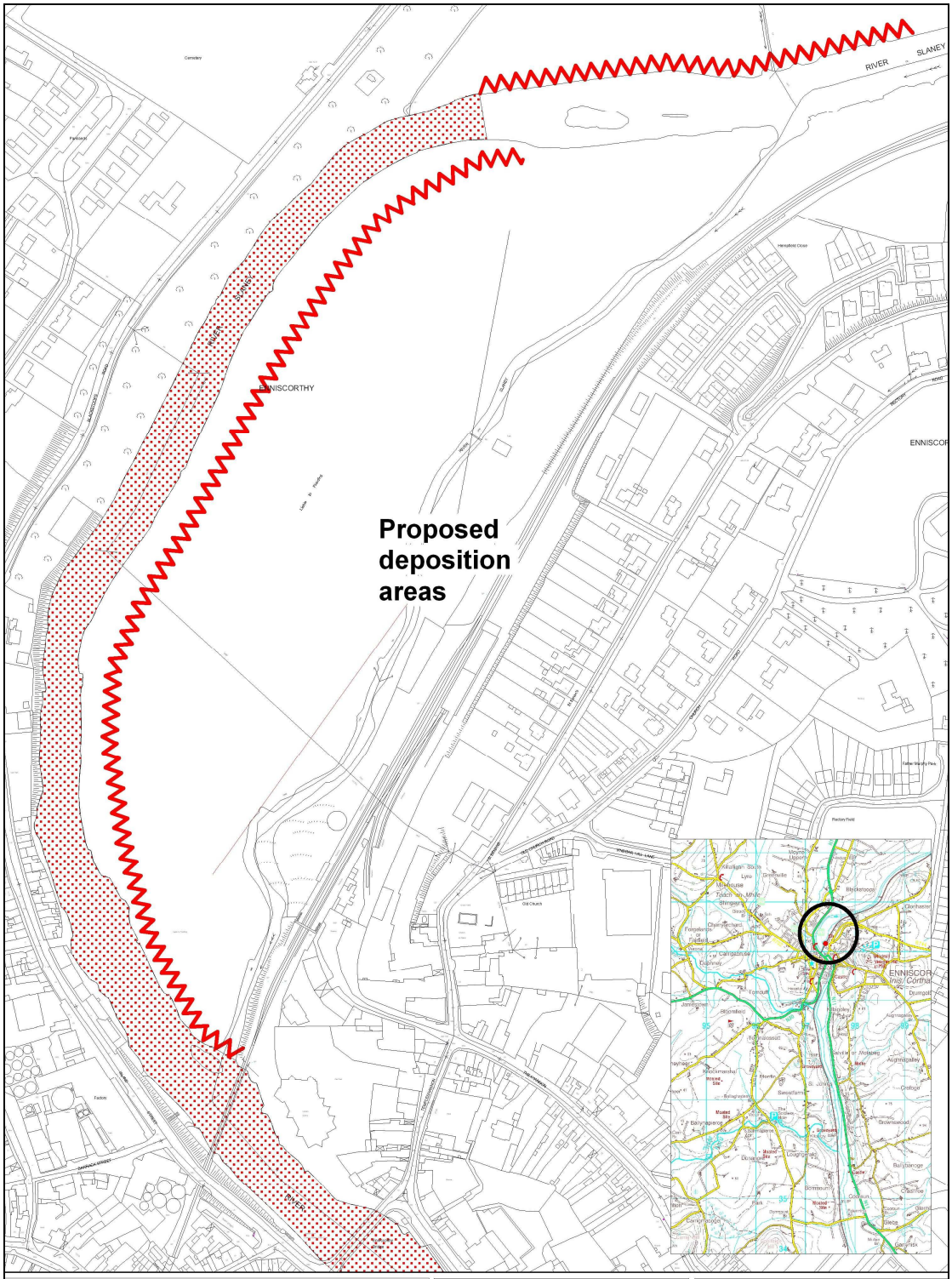


Figure 3.3c Option C – River Widening upstream of the Town



Key:

River widening

River regrading (dredging)

Title:
Option D
(upstream of Enniscorthy)

Project:
River Slaney (Enniscorthy)
Flood Relief Scheme

Client:
Office of Public Works

Date:
February 2009

Scale:
Not to Scale

Figure: 3.3c

ROYAL HASKONING

Conclusions

3.3.19 **Table 3.1** summarises the potential impacts of the proposed options, and the following paragraphs provide a summary description of the impacts associated with each option. In addition, **Table 3.2** summarises the impacts with particular reference to the qualifying species listed within the Slaney Valley candidate Special Area of Conservation (cSAC) designation.

3.3.20 Each option is required to provide flood protection for the town of Enniscorthy up to and including the 100-year design flood event. The performance of a scheme in a "Natural Failure" scenario (i.e. where a flood greater than the 100-year design event defeats the scheme defences and causes flooding) forms part of the decision making process for finding the preferred solution to the Enniscorthy flooding problem. The ease with which a scheme option can be altered in the future to accommodate expected Climate Change, should it occur, is similarly significant.

Option A - Do Nothing

3.3.21 Although the do-nothing option does not change natural environment, the lack of information regarding the long term geomorphology of the river leaves a significant gap in understanding of likely future changes, particularly as a result of climate change and its associated effects. However, the frequency of sporadic flooding within Enniscorthy is expected to more than double by 2050 due to climate change. As well as the resulting economic damage, individual residents and commercial premises would be significantly affected, with properties evacuated during floods as well as suffering flood damage. Flooding would also result in the closure of the road bridges and the railway bridge, with significant access impacts (including emergency vehicles).

Option B - Flood Walls (Demountable)

3.3.22 Option B would avoid much of the impacts on economy, residents, commerce and road access (but would not reduce flooding of rail links), and other less determinable impacts (such as health and safety). Initially, disturbance during construction would cause localised impacts (noise, disruption, visual disturbance); however, the long-term impacts of the defences would be limited. Visual impact would be associated with permanent and demountable flood defences, however, the demountable defences would only have a temporary impact (i.e. during flood events).

3.3.23 This option requires the development and implementation of a Flood Forecasting and Warning System capable of providing sufficient advanced notice to set up the demountable defence structures; if this is not possible then Option B is not feasible. Likewise, if a false 'All Clear' is given then the town will flood and there will be no benefit from the defence scheme for that event.

3.3.24 Option B would produce flood levels within the channel that are between 0.8 and 1.1m higher than those that would occur if no scheme was in place. During the "Natural Failure" scenario, therefore, flooding would be more extensive and deeper than would occur if no defences were erected. This flooding would also take longer to remove due to inherent difficulties (caused by the flooding) in removing elements of the defences to aid release of waters back to the river.

3.3.25 This means that the Flood Forecasting and Warning System would also need to provide a "Natural Failure" warning (i.e. it would need to distinguish between floods that are less than the design flood so that defences could be put in place) and floods that are greater than

the design flood (when the defences should not be erected thereby leaving the town to flood to its natural depth and save it from the additional extent and depth that would be produced by the defences). If, therefore, a flood alert was given that resulted in the erection of the defence structures and the actual flood was greater than the design flood then flooding would be worsened by the scheme and this could lead to litigation both in relation to increased damages and worsening of Health and Safety conditions. Likewise, if a false "Natural Failure" was given (i.e. the system registered the event as being greater than the design flood and it was not) then the town would be flooded by an event less than the design flood (i.e. there would be no benefit), and this could lead to litigation.

3.3.26 Although no dredging or widening works would be necessary, the permanent and demountable flood defences would alter river hydrology during high water events both throughout the length of the scheme (i.e. within the town) and for a distance of, at least, 1.5km upstream of the railway bridge. In this upstream stretch, it has been estimated that levels will increase by between 0.5 and 0.75m and flow velocities would be lower thereby inducing increased deposition. Along with this, estimated flow velocity changes within the town indicate an altered geomorphology that would increase erosion in areas where erosion already occurs and increase deposition in areas of low velocity. While flood events are short-lived, they can produce dramatic erosion and accretion on the River Slaney and would also induce a general movement of the sandbars. However, the heavier gravel substrate associated with this area is unlikely to be significantly affected.

3.3.27 Holding pools could become more pronounced while sandbars (such as those alongside the public car park just downstream of the Riverside Park Hotel, Shannon Quay and in the area upstream of the railway bridge) would be likely to grow, so this effect is significant for fish and other aquatic flora and fauna. During low flow periods these changes could exacerbate these barriers to the migration of fish and this could, in turn, potentially lead to decreasing numbers spawning upstream. A reduction in the fishery resource could also have knock-on effects for otters, and other nature conservation interests. The nature of this scheme option implies that mitigation measures such as fish passes to facilitate upstream migration, etc. may not be sufficient to reverse these potential impacts.

3.3.28 This change in geomorphology could also lead to failure of the flood relief scheme during an event that is less than the 100-year design flood. Deposition of a sufficient quantity of materials at any of the existing sandbars either immediately downstream or within the town could raise the upstream flood level enough to overtop defence walls and flood the town. It is not possible to assign, with confidence, a defence design standard to this scheme.

Option C - Flood Walls, Local Alleviation Measures and Limited Dredging

3.3.29 Option C would avoid the impacts on economy, residents, commerce and road access (but would not reduce flooding of rail links), and other less determinable impacts (such as health and safety). Initially, disturbance during construction would cause localised impacts (noise, disruption, and visual disturbance). Other potential impacts could occur to protected species such as otter, due to river excavation and in-river works are likely to cause localised water quality impacts that could also indirectly affect aquatic fauna such as salmon and otter. However, mitigation measures (such as timing of works) could be implemented to minimise the magnitude of any potential impact. In addition, works under the road and railway bridges, as well as dredging, have the potential to disturb or damage features of archaeological or historical interest.

3.3.30 The permanent defence structures would result in a visual obstruction within the river landscape, however, the magnitude of the impact would be significantly less than for Option B, due to the in-river works associated with this option. Particularly downstream of the town, river excavation could potentially have a significant effect on the hydrology of the river. The number of protected species present in and adjacent to the river and the designated status of the river means that a significant negative impact could also occur to the natural environment (loss of or disturbance to designated habitat, change in river characteristics affecting migratory fish or altering river fauna diversity and densities) such that a significant adverse effect on the integrity of the River Slaney cSAC could arise. In order to prevent or minimise the impact on the habitats and species in the cSAC, hydrological modelling would be undertaken for a variety of river states, in order to help design the in-river features to prevent any noticeable change in the rivers hydrological regime.

3.3.31 A waste management strategy would need to be drawn up to manage the large volume of material to be dredged from the river and excavated as a result of river widening.

3.3.32 River widening downstream of the town would convert an area of existing floodplain to a new berm area of aquatic habitat. Medium to high flows with various combinations of tidal influence would flood out onto this berm, thereby providing an area alternatively exposed or under water. The range of extreme flow velocities in this area would be reduced so the degree of sediment erosion, transportation and deposition would be lower than current levels. This represents a potential improvement to the geomorphology aspect of this cSAC area.

3.3.33 While flood velocities are lowered slightly between Seamus Rafter Bridge and the railway bridge they would noticeably increase in the upstream area. The indicated change in geomorphology could well exacerbate present day areas of erosion and accretion. While flood events are short-lived, they can produce dramatic erosion and accretion on the River Slaney so the increase in upstream erosion and the transportation of the resulting sediment indicates increased deposition in areas of lower flow velocity within the town and in the downstream river stretch than would be expected under the existing situation. However, the heavier gravel substrate associated with this area would not be significantly affected. While this effect is not as pronounced as for Option B it still implies that holding pools could potentially become more pronounced while sandbars would be likely to grow. During low flow periods these changes could exacerbate these barriers to the migration of fish and this could, in turn, lead to decreasing numbers spawning upstream. A reduction in the fishery resource could also have knock-on effects for otters, etc. The nature of this scheme option does benefit from mitigation measures such as fish passes to facilitate upstream migration, etc. and these may be sufficient to reverse these impacts.

3.3.34 The effect of flooding on health and safety is reduced in the “Natural Failure” case when a flood greater than the design flood occurs. The extent of flooding within the town would be reduced and flood depths would be between 0.25 and 0.5m lower than under present conditions so the likelihood of loss-of-life would be somewhat reduced.

3.3.35 There exists however the possibility that this change in geomorphology (sediment erosion, transportation and deposition) could lead to failure of the flood relief scheme during an event that is less than the 100-year design flood. Deposition of a sufficient quantity of materials either within the town or immediately downstream of it could raise the upstream flood level enough to overtop the defence wall and flood the town. While the changes in flood velocities, produced by Option C, are significantly less than those produce by Option B, this still implies a risk of failure of the scheme at flows smaller than the design flow.

Option D - Flood Walls, Local Alleviation Measures and Dredging

3.3.36 Option D would avoid the impacts on economy, residents, commerce and road access (but would not change access to rail links), and other less determinable impacts (such as health and safety). Initially, disturbance during construction would cause localised impacts (noise, disruption, and visual disturbance). Due to river widening other potential impacts may occur to protected species such as otter, and the in-river works would be likely to cause localised water quality impacts that could also indirectly affect terrestrial and aquatic fauna such as salmon, and otter. In particular, the destruction of an otter holt is a potentially significant impact. However, mitigation measures (such as timing of works, construction of artificial otter holt, etc) could be implemented to minimise the magnitude of any potential impact. In addition, works under the road and railway bridges, as well as dredging, would have the potential to disturb or damage features of archaeological or historical interest.

3.3.37 The permanent defence structures would result in a visual obstruction within the river landscape, however, the magnitude of the impact would be significantly less than for Option B due to the in-river works associated with this option, and noticeably less than for Option C. Particularly in the areas immediately upstream and downstream of the town, river excavation could potentially result in a significant effect on the hydrology of the river. The number of protected species present in and adjacent to the river and the designated status of the river means that a significant negative impact could also occur to the natural environment (loss of or disturbance to designated habitat, change in river characteristics affecting migratory fish or altering river fauna diversity and densities) such that a significant adverse effect on the integrity of the Slaney Valley cSAC could arise. In order to prevent or minimise the impact on the habitats and species in the cSAC, hydrological modelling would be undertaken for a variety of river states, in order to help design the in-river features and prevent any noticeable change in the rivers hydrological regime.

3.3.38 A waste management strategy would need to be drawn up to manage the large volume of material to be dredged from the river and excavated as a result of river widening.

3.3.39 As with Options B and C the potential impacts upon bridges within Enniscorthy and also the roads crossing those bridges need further consideration. Existing high water levels already result in overtopping of Seamus Rafter Bridge and water levels approaching the top of Enniscorthy Bridge. The resultant high water levels associated with retaining flood waters within the existing channel could result in the overtopping of all three bridges within Enniscorthy and may exacerbate localised flooding in those areas. Further investigation would also need to be undertaken to determine if the associated extra loading placed on those bridges could potentially lead to structural damage.

3.3.40 Option D incorporated ‘river widening’ works upstream and downstream of the town that converts an area of existing floodplain to a new berm area of aquatic habitat. All of this land would fall within the Slaney Valley cSAC. Medium to high flows with various combinations of tidal influence would flood out onto this berm, thereby providing an area alternatively exposed or under water and providing an opportunity for lamprey spawning etc. Remedial measures would include the planting of appropriate aquatic and soft riverbank vegetation in this area. As such, this represents a potential improvement to the flora and fauna aspect of the cSAC designation as the incorporation of berms throughout this length could actually increase habitat diversity.

3.3.41 Re-grading the riverbed under both the Railway Bridge and Enniscorthy Bridge would remove the existing obstacles to upstream migration and may facilitate fish movement in these areas. Fish are currently held in pools downstream of these obstructions until water levels are high enough to progress further upstream. Consequently, greater numbers of returning fish would be able to reach the spawning grounds further upstream and this could also have knock-on positive effects for otters, etc. The nature of this scheme option does benefit from mitigation measures such as fish passes to facilitate upstream migration, etc. and these could bring about further benefit.

3.3.42 While flood events are short-lived, they can produce dramatic erosion and accretion on the River Slaney, however, as the range of extreme flow velocities throughout the scheme would reduce, the degree of sediment erosion, transportation and deposition would be lower than those which occur at-present. This represents a potential improvement to the geomorphology aspect of this cSAC.

3.3.43 This scheme produced a greater reduction in velocity in the area upstream of Enniscorthy and an overall effect of having lower velocities in this upstream area than through the town. Geomorphology is more stable under Option D than that which currently occurs. With this, the low velocities in the upstream stretch ensures that sediment load transported into the area from further upstream would either deposit out in this area or, due to the higher velocities within the town, would be transported safely to the area downstream of the town. This implies that Option D removes the risk of failure of the scheme at flows smaller than the design flow that could result from build-up of sediments within the town.

3.3.44 The effect of flooding on health and safety is reduced in the “Natural Failure” case when a flood greater than the design flood occurs. The extent of flooding within the town would be reduced and flood depths would be between 0.5 and 1.25m lower than under present conditions, i.e. if the town remained unprotected so the likelihood of loss-of-life would, therefore, be reduced.

3.3.45 A “Sediment Trap” is to be constructed at the upstream extent of this lower velocity area; this would remove the dangerous sediment transporting into the scheme area. This “Sediment Trap” would take the form of a wide short stretch of river with large boulders capable of dissipating floodwater energy. This also means that sediment removal would be located at this site thereby reducing the impact of future scheme maintenance.

Table 3.1 Summary of the Potential Impacts

Description of Impact	Option			
	Do Nothing	B	C	D
Human Beings				
Residential property and community	××××	✓✓✓	✓✓✓✓	✓✓✓✓
Local employment	××	✓✓	✓✓	✓✓
Local economic effects	×××	✓✓✓	✓✓✓✓	✓✓✓✓
Health and safety	×××	✓✓	✓✓✓✓	✓✓✓✓
Angling access (construction)	O	O	O	O
Angling access (operation)	O	O	O	O
Recreational navigation	O	O	O	O
Emergency access	××××	✓✓	✓✓✓	✓✓✓
Amenity (construction)	na	×××	×××	×××
Amenity (operation)	××	✓✓	✓✓	✓✓
Visual amenity (construction)	××	×××	×××	×××
Traffic (construction)	na	×××	×××	×××
Traffic (operation)	××××	✓✓	✓✓✓✓	✓✓✓✓
Fauna				
Otters (construction)	na	×	××	×××
Otter habitat (operation)	O	×××	O	✓✓ - ✓✓✓
Badgers (construction)	na	O	O	O
Badger habitat (operation)	O	×	O	O
Bat roosts (construction)	O	O	O	O
Fish and their habitat (construction)	na	×	×	××
Fish and their habitat (operation)	O	××××	✓✓ - ✓✓✓	✓✓✓
Birds and their habitat (construction)	na	O	O	O
Birds and their habitat (operation)	O	O	O	O
Freshwater pearl mussel	O	O	O	O
Re-suspended sediments (construction)	na	O	?××	×××
Contaminant mobilisation effects (construction)	na	?×	?×	?××
Contaminant mobilisation effects (operation)	?××	?××	?××	?××
Flora				
Designated sites (construction)	na	××	×××	×××
Designated sites (operation)	na	?××××	×	✓✓
Terrestrial habitat (construction)	na	××	××	××
Terrestrial habitat (operation)	O	O	××	×× - ×××
Aquatic habitat (construction)	na	××	××	×××
Aquatic habitat (operation)	O	?×××	✓✓✓	✓✓
Protected species	O	O	O	O
Soils and Geology				
Geomorphology	O	×××	× - ×××	✓✓✓
Drainage	O	× - ××	✓✓	✓✓
Geological deposits	O	O	O	O

Description of Impact	Option			
	Do Nothing	B	C	D
Water				
Hydrological regime	O	×	××	××
Accidental spillages	O	O	O	O
Re-suspended sediments (construction)	na	× - ××	?××	×××
Re-suspended sediments (operation)	O	O	O	O
Contaminant mobilisation (construction)	na	?×	?×	?××
Contaminant mobilisation (operation)	?××	?××	?××	?××
Abstractions/Discharges (construction)	na	×	×	×
Abstractions/Discharges (operation)	O	O	O	O
Air, Noise and Vibration				
Air, noise and vibration (construction)	na	××	××	××
Air, noise and vibration (operation)	O	O	O	O
Climate				
Climate change	O	?	?	?
The Landscape				
Urban/riverside landscape character	O	×××	×××	×××
Floodplain landscape	O	×	×	×
Material Assets				
Railway lines (including bridges)	?	O	O	O
Roads (including bridges)	?	✓✓✓✓	✓✓✓✓	✓✓✓✓
Soil resources	O	O	?	?
Water resources	O	O	O	O
Navigation	O	O	O	O
Cultural Heritage				
Historic monuments	××	×	×	O
Unknown heritage resource	O	O	O	O

Key:

✓✓✓✓	Positive Impact (major)	××××	Negative Impact (major)
✓✓✓	Positive Impact (moderate)	×××	Negative Impact (moderate)
✓✓	Positive Impact (minor)	××	Negative Impact (minor)
✓	Positive Impact (negligible)	×	Negative Impact (negligible)
O	No Anticipated Impact	?	Potential Impact
na	Not applicable		

Table 3.2 Summary of the Potential Impacts upon cSAC Qualifying Species

Qualifying Species / Habitats	Potential Impacts for Option			
	A	B	C	D
Atlantic salmon	None	**Construction**: **Negligible negative impact** predicted provided ERFB close season is adhered to. **Operation**: Potential for increased erosion downstream of bridges leading to increased difficulty for fish to migrate upstream. **Potential minor-moderate negative impact** without mitigation. Successful mitigation measures (such as construction of fish passes) should reduce or completely avoid the potential impact.	**Construction**: **Negligible negative impact** predicted provided ERFB close season is adhered to. **Operation**: Dredging of river channel could result in removal of in-river obstacles, thereby aiding upstream migration and increasing the number of returning and spawning salmon. As a result there is a potential **minor to moderate positive impact**.	**Construction**: **Minor negative impact** predicted (due to increased area of works) provided ERFB close season is adhered to. **Operation**: Dredging of river channel could result in removal of in-river obstacles, thereby aiding upstream migration and increasing the number of returning and spawning salmon. As a result there is a potential **minor to moderate positive impact**.
Otter	None	**Construction**: existing human activity within the town and the small area of river frontage to be affected at any one time result in a **negligible negative impact** **Operation**: a potential short-term increase in upstream flooding (during high water events) result in a potential **minor negative impact**	**Construction**: An additional 1.5km of bankside habitat (20+ha) will be disturbed downstream consequently a **minor to moderate negative impact** is predicted. **Operation**: Widening of channel downstream will create a new berm that will represent approximately 20+ha of new riparian habitat. As such a **minor to moderate positive impact** is predicted.	**Construction**: In total approximately 2.5km of bankside habitat, upstream and downstream of Enniscorthy, will be disturbed (approximately 40+ha). A **minor to moderate negative impact** is predicted. **Construction**: River widening will result in the destruction of an otter holt. A **moderate negative impact** is predicted in the short-term. Successful mitigation measures (construction of artificial otter holts) should reduce or completely avoid the potential impact. **Operation**: Widening of channel up and downstream will create a new berm that will represent approximately 40+ha of new riparian habitat. As such a **minor to moderate positive impact** is predicted.
Freshwater pearl mussel	None	Nearest populations thought to be approximately 20km upstream. Therefore **no impact** anticipated.	Nearest populations thought to be approximately 20km upstream. Therefore **no impact** anticipated.	Nearest populations thought to be approximately 20km upstream. Therefore **no impact** anticipated.

Qualifying Species / Habitats	Potential Impacts for Option			
	A	B	C	D
Lamprey (river, sea, brook)	None	**Construction**: **Negligible negative impact** predicted provided ERFB close season is adhered to.	**Construction**: **Negligible negative impact** predicted provided ERFB close season is adhered to. **Operation**: Dredging of river channel could result in removal of in-river obstacles, thereby aiding upstream migration and increasing the number of spawning individuals. As a result there is a potential **minor to moderate positive impact**.	**Construction**: **Minor negative impact** predicted (due to increased area of works) provided ERFB close season is adhered to. **Operation**: Dredging of river channel could result in removal of in-river obstacles, thereby aiding upstream migration and increasing the number of spawning individuals. As a result there is a potential **minor to moderate positive impact**.
Allis / twaite shad	None	**Construction**: **Negligible negative impact** predicted provided ERFB close season is adhered to.	**Construction**: **Negligible negative impact** predicted provided ERFB close season is adhered to. **Operation**: Dredging of river channel could result in removal of in-river obstacles, thereby aiding upstream migration and increasing the number of spawning individuals. As a result there is a potential **minor to moderate positive impact**.	**Construction**: **Minor negative impact** predicted (due to increased area of works) provided ERFB close season is adhered to. **Operation**: Dredging of river channel could result in removal of in-river obstacles, thereby aiding upstream migration and increasing the number of spawning individuals. As a result there is a potential **minor to moderate positive impact**.
Mudflats	None	None	None	None
Estuaries	None	None	None	None
Floating river vegetation	None	The nearest construction works are approximately 4km upstream of the nearest known population of short-leaved water starwort. Consequently, **no impact** is anticipated.	The nearest construction works are approximately 3km upstream of the nearest known population of short-leaved water starwort. Consequently, **no impact** is anticipated.	The nearest construction works are approximately 4km upstream of the nearest known population of short-leaved water starwort. Consequently, **no impact** is anticipated.
Alluvial forests	None	None	None	None
Old sessile oak woods	None	None	None	None

Natural Failure Scenario

3.3.46 The potential impacts that would arise from failure of the defences provided by the three intervention options (i.e. Options B, C, and D) were also examined. Each option ensured that flooding will not occur for events up to the magnitude of the 100-year 'design flood' and the design and construction of each element of the successful option, such as a flood defence wall, etc., ensure that failure will not occur, for example, due to a wall collapse. A flood defence scheme, however, will fail when a flood greater than the design standard occurs; as it is natural that something will fail when operating beyond its design limits, this is referred to as 'natural failure'. The events taken into account in this assessment are those greater than the 100-year 'design flood' and less than the 500-year event. The impact of the resulting flooding for each option was assessed against the degree of flooding that the same event would cause under the do-nothing (present-day) condition over a period of 50 years. The likelihood of such extreme events occurring is low and this is taken into account in estimating that the likely damage to properties alone under present-day conditions, over a period of 50 years, has been estimated at €27.6M. The amount by which each of the three options increases or reduces this damage was used to evaluate each option's performance. It transpired that the three options operate quite differently in this mode.

3.3.47 **Table 3.3** summarises the key and potentially significant impacts that could arise as a result of a failure of the three defence options through the town of Enniscorthy. The table summarises the impacts likely as a result of a single natural failure event, and does not identify the potential cumulative impacts if this occurred more than once. In addition, the impacts examined are only those that would be significantly affected by such an event, which concerns short-term impacts only.

Table 3.3 Summary of Impacts as a Result of Natural Failure during a Flood Event

Description of Impact	Present-day (i.e. No Scheme)	Option		
		B	C	D
Human Beings				
Property damage/costs	€43.4M	€44.6M	€32.2M	€30.7M
Residential property and community	×××	××××	×××	××
Health and safety	×××	××××	×××	××
Emergency access	×××	××××	×××	××
Amenity	××	×××	××	×
Traffic access	×××	××××	×××	××
Material Assets				
Railway lines (including bridges)	×××	××××	××	×
Roads (including bridges)	×××	××××	××	×
Cultural Heritage				
Historic monuments	××	×××	×	×

3.3.48 Option B uses high demountable defences to hold the flood within the river and, in so doing, removes the presently available opportunity to floodwaters of flowing down along the quays and riverside roads. As a result, Option B produces flood levels within the channel that are between 0.8m and 1.1m higher than those that would occur if no scheme was in place. During the "Natural Failure" scenario, therefore, water would overtop the defences so flooding in the town would be between 0.8m and 1.1m deeper than would occur if no defences were erected and, obviously, the flooded area would also be more extensive. This flooding would also remain longer due to inherent difficulties in removing elements of the defences to aid release of waters back to the river.

3.3.49 The prospect of additional damage, and the increased risks associated with it, means that the Flood Forecasting and Warning System that forms part of Option B would also need to provide a "Natural Failure" warning. It would, therefore, need to distinguish between floods that are less than the design flood (so that defences could be put in place) and floods that are greater than the design flood (when the defences should not be erected thereby leaving the town to flood to its normal depth and save it from the additional extent and depth that would be produced by the defences). If, however, either the warning system failed to recognise a "Natural Failure" condition or gave a false "Natural Failure" warning (i.e. the system registered the event as being greater than the design flood and it was not) then the town would be allowed flood (i.e. both would incur additional flooding damage.) The likely additional damage to properties, over a period of 50 years, has been estimated at €6.9M.

3.3.50 With Option B "Natural Failure" would also negatively impact health and safety as the resulting 3m to 4m flood depths carry with them a significant likelihood of loss-of-life, etc. As the extent, depth and duration of flooding are increased, traffic would also be disrupted leading to delays in the emergency response services further impacting health and safety. It is also reasonable to conclude that local employment and the local economy would suffer.

3.3.51 Option C uses defence walls to hold the flood within the river and, in so doing, removes the opportunity to floodwaters of flowing down along the quays and riverside roads. Unlike Option B, however, it compensates for this loss by increasing the conveyance capacity of the channel through additional engineering measures so that flood depths would be between 0.25m and 0.5m lower than those under present conditions. This means that the effect of flooding is reduced in the "Natural Failure" case as flood depths would be between 0.25m and 0.5m lower than those under present conditions (i.e. if the town had remained unprotected). The likely reduction in damage to properties alone, over a period of 50 years, has been estimated at €11.2M.

3.3.52 For Option C "Natural Failure" would also reduce the impact that flooding has in Enniscorthy on health and safety as the extent, depth and duration of flooding are reduced and, as traffic would experience less disruption, obstruction and delays in the emergency response services would reduce thereby further reducing the risk to health and safety. It is also reasonable to conclude that local employment and the local economy would consequently benefit.

3.3.53 Option D also uses defence walls to hold the flood within the river. Like Option C, it compensates for this loss by increasing the conveyance capacity of the channel through additional engineering measures, however, its measures lower flood depths by between 0.5m and 1.25m below those that pertain under present conditions. This means that the effect of flooding is reduced in the "Natural Failure" case (i.e. flood depths would be between 0.5m and 1.25m lower than those that would pertain under present conditions if

the town had remained unprotected). The likely reduction in damage to properties alone, over a period of 50 years, has been estimated at €12.7M.

3.3.54 Similarly, Option D goes further than Option C in reducing the impact of "Natural Failure" flooding in Enniscorthy on health and safety as the extent, depth and duration of flooding are additionally reduced and, as traffic would also experience even less disruption, obstruction and delays in the emergency response services are minimised thereby further reducing the risk to health and safety. It is also reasonable to conclude that local employment and the local economy would consequently benefit most from this option.

3.3.55 The key factor influencing the potential impacts is the increase or decrease in the extent, depth and duration of flooding resulting from the natural failure scenario. *Option B would result in an increase (0.8m to 1m) in depth of flooding above those at present, Option C would result in a decrease (0.25m to 0.5m) in the depth of flooding above those at present, and Option D would result in a decrease (0.5m to 1.25m) in the depth of flooding.* It is clear that, as Option B increases flooding it would result in impacts of greater magnitude than the do-nothing scenario (Option A), with reductions in the scale and magnitude of impacts occurring as a result of Options C and D. It is determined that due to the significant reduction in flood depths as a result of Option D, this option performs well in reducing the impacts of such an event, and also copes well with possible changes in hydrology and flooding types that could arise as a result of climate change.

Recommendations

3.3.56 The economic and social costs of doing nothing (i.e. Option A) are of such significance that this would be unacceptable in terms of a sustainable flood defence option. Furthermore, although little quantifiable detail is available, the potential effects of climate change could result in negative consequences for migratory fish species. This would occur as a result of hydrological and geomorphological changes.

3.3.57 Options B, C and D prevent the negative social and economic effects of doing nothing but all result in both human and natural environment impacts. Many of the disturbance impacts associated with the construction phase of the three options are short-term in nature and would cease on completion of the works, so the dominant aspects in characterising the sustainability of the options are the long term impacts, except for the historic environment. Options C and D have the potential to disturb features of archaeological and historical interest due to the works to the bridges, dredging and river widening. However, the majority of impacts during construction can be avoided or minimised through appropriate mitigation measures.

3.3.58 In terms of the long-term effect on the human environment, Option B results in a significantly greater visual impact due to the necessity for higher flood walls and embankments, though some of these are demountable and therefore temporary in nature. Option D results in the least visual impact.

3.3.59 In terms of the effects on the river as a feature (and linked with its associated habitats and species), Options C and D have a significant potential to affect the hydrology and geomorphology of the river, such that potentially significant impacts could occur on the designated site (cSAC), as well as protected species (salmon and otter), as well as species for which the river is designated. Option B also has the potential to affect the hydrology of the river, however, the extent to which this could occur is significantly less than for Options C and D. At present, there is insufficient information to quantify the potential effects, however, it is stated in the engineering reports that design features would

be incorporated that would avoid alteration to the hydrological regime, thereby limiting the impact on the natural environment to the construction phase impacts and footprint of each option. Consequently, Option D would reduce the potential visual impact of the scheme, and create additional river and bankside habitat, to a greater degree than Option C. Option C also provides similar benefit but not at as great a scale as Option D, but greater than Option B. Furthermore, Option D could also incorporate measures that would alleviate potential impacts resulting from the physical alteration arising from climate change effects, particularly on the migratory fish species.

3.3.60 When the natural failure scenario is incorporated it is evident that Option D results in far less risks to the built and human environment, and appears overall to minimise impacts on the human and natural environment, as well as minimising risks, and providing an adaptive approach to climate change effects.

3.4 Proposed Drainage Scheme

3.4.1 Enniscorthy Drainage Scheme utilises works to improve flow conveyance, and containment measures to prevent flooding within Enniscorthy. The scheme contains a number of localised measures including the removal of Seamus Rafter Bridge and its replacement with a bridge downstream of the Riverside Park Hotel.

3.4.2 The scheme detail and layout are described based on the type of works proposed, and these are then broken down into discreet sections of the river, running from downstream to upstream.

Increase Conveyance and Flow Diversion

3.4.3 A key part of the scheme entails deepening and/or widening along various sections of the river in and adjacent to Enniscorthy. These river works are essential in reducing the flood water levels which minimises the amount of wall raising that is required, but furthermore, the in-river works are also designed to reduce and remove obstructions to fish (salmon, trout, shad, eel, and lamprey) passage, as well as to enhance the environment for protected species such as otter in order to enhance the overall characteristics of the Slaney Valley cSAC.

Downstream of the Riverside Park Hotel

3.4.4 A flood diversion channel will extend from the left bank of the river opposite the downstream end of the Riverside Park Hotel (Grid Reference 297440 139290), running across the meadows to the south for a distance of 1.25km and re-entering the river at chainage 3600, as shown on **Figure 3.4**. The channel would be 25m wide at its base and approximately 33m wide or more at ground level, and it would be between 3.5m and 4.0m below ground level. A long section of the Diversion Channel is presented in **Figure 3.5**.

3.4.5 The upstream end of the Diversion Channel (opposite from the Riverside Park Hotel) will be controlled by a weir system with a crest height set at approximately 2.10m Malin (4.75m Poolbeg). However, the weir crest level will be defined in the Detailed Design Phase, and this will be agreed with the Eastern Regional Fisheries Board (ERFB) and the National Parks and Wildlife Service (NPWS). The weir will also contain a fish passage in the event of any fish entering the Diversion Channel during low flow conditions. The fish pass will be designed in the Detailed Design Phase, and the design will be agreed with the ERFB and the NPWS.

Figure 3.4 Diversion Channel Location and Extent

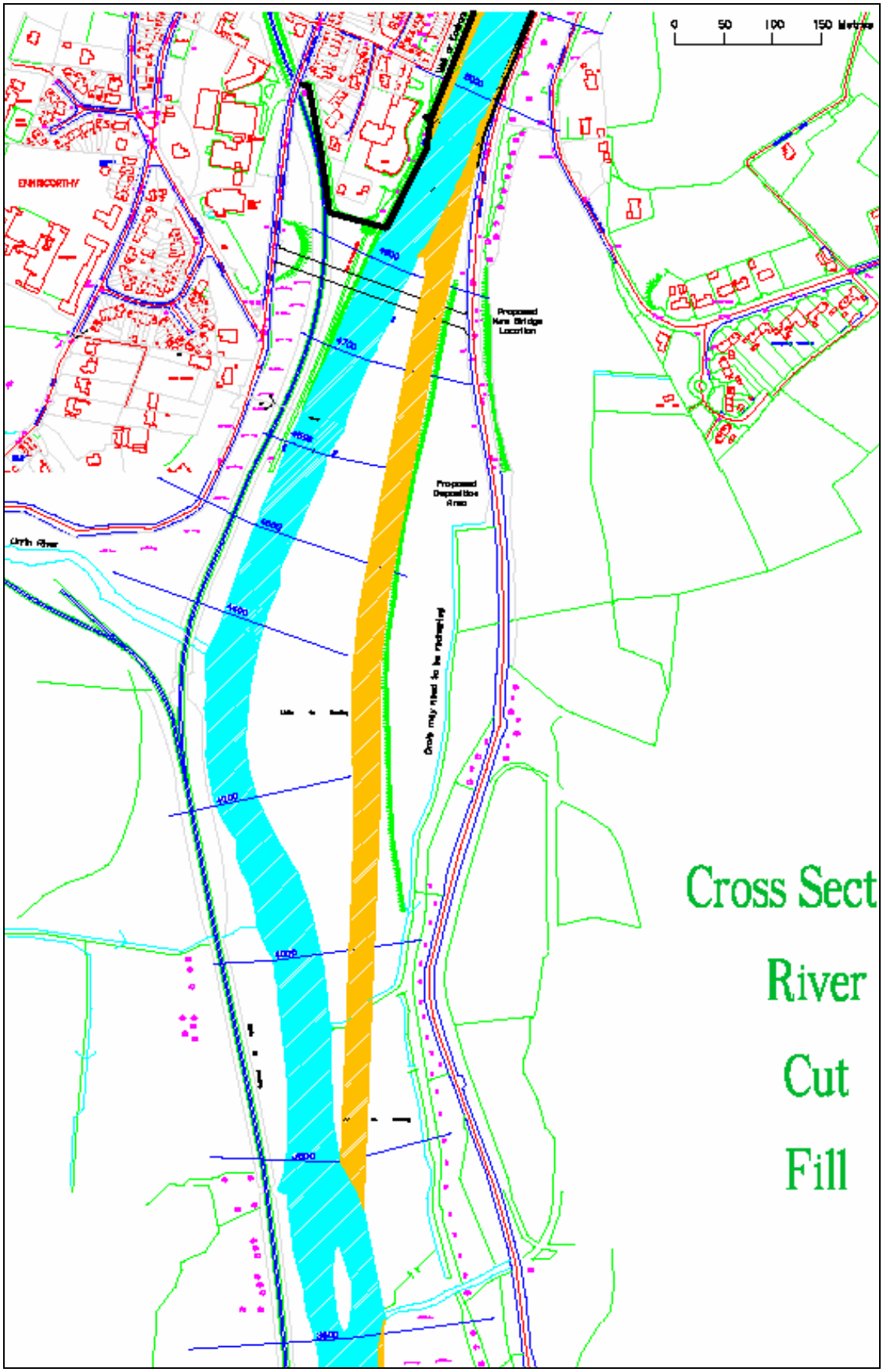
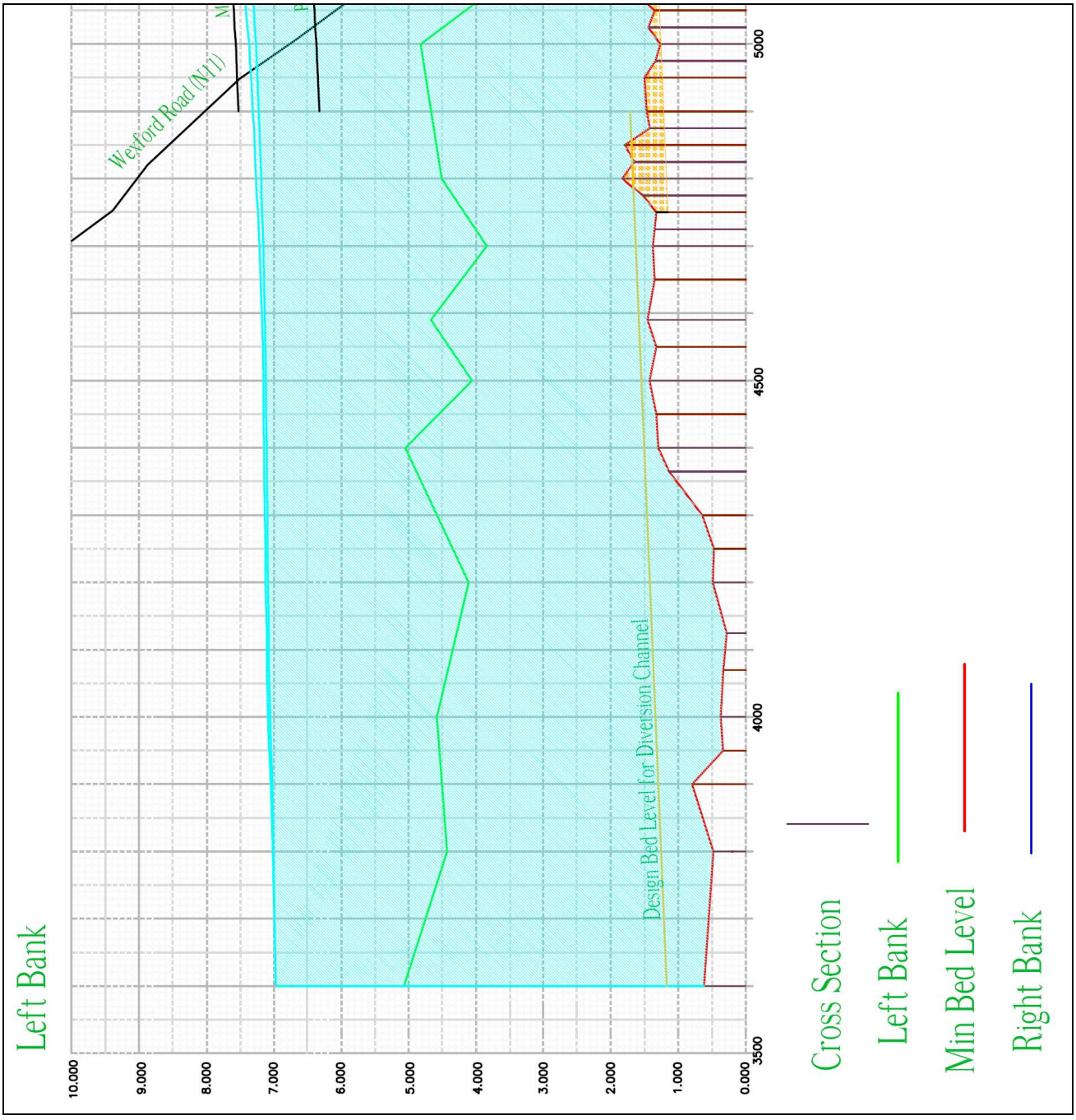


Figure 3.5 Diversion Channel Long Section



Upstream of the Riverside Park Hotel to Seamus Rafter Bridge

3.4.6 On the right bank of the river from the northern end of the Riverside Park Hotel at chainage 4960 (Grid Reference 297430 139390) to Seamus Rafter Bridge (chainage 5356), the river bank would be widened by between 2.5m and 8m (approximately 5,050m^2), as shown on **Figure 3.6**. **Figure 3.7** presents cross sections along this stretch.

Figure 3.6 Diversion Channel Long Section

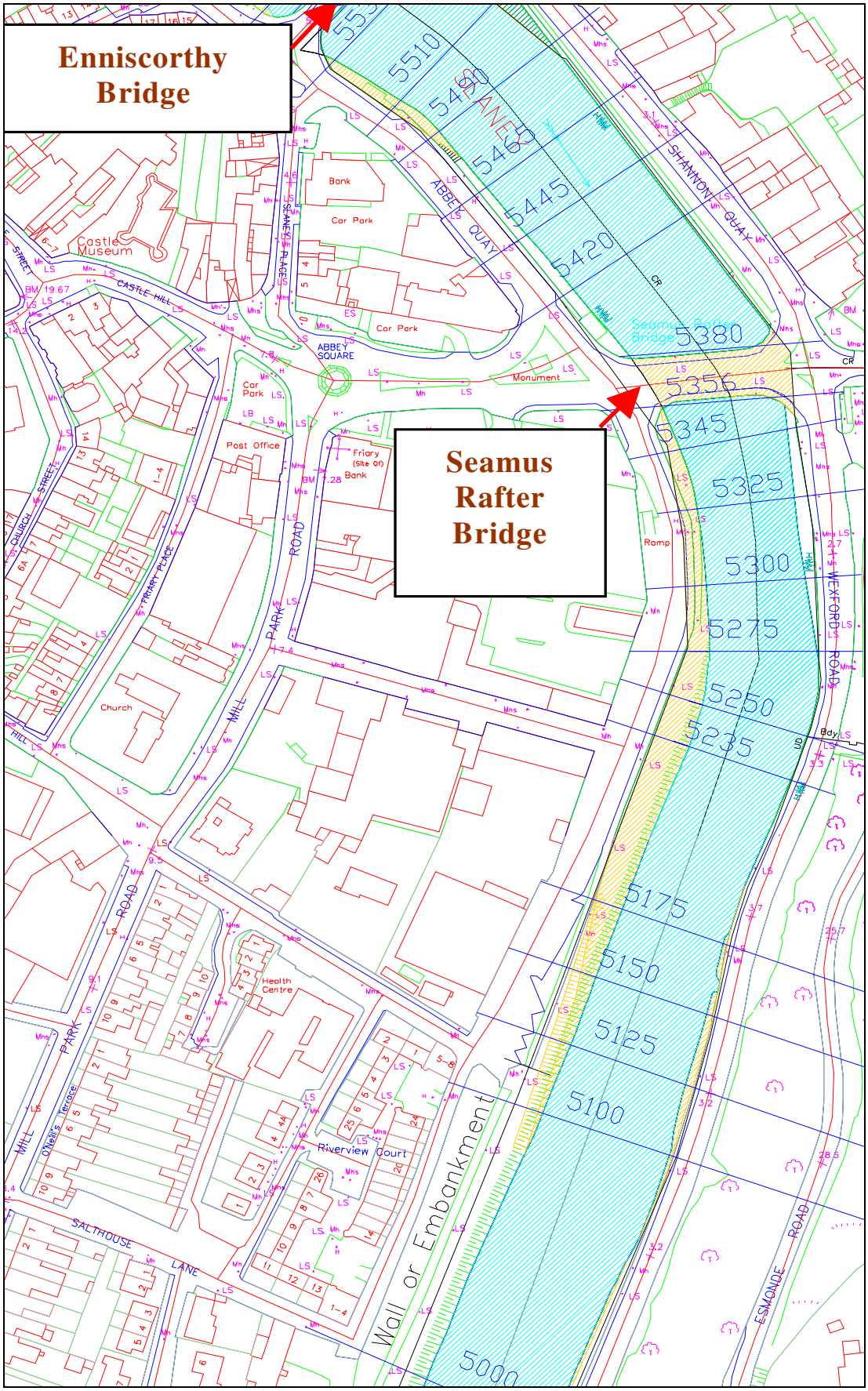
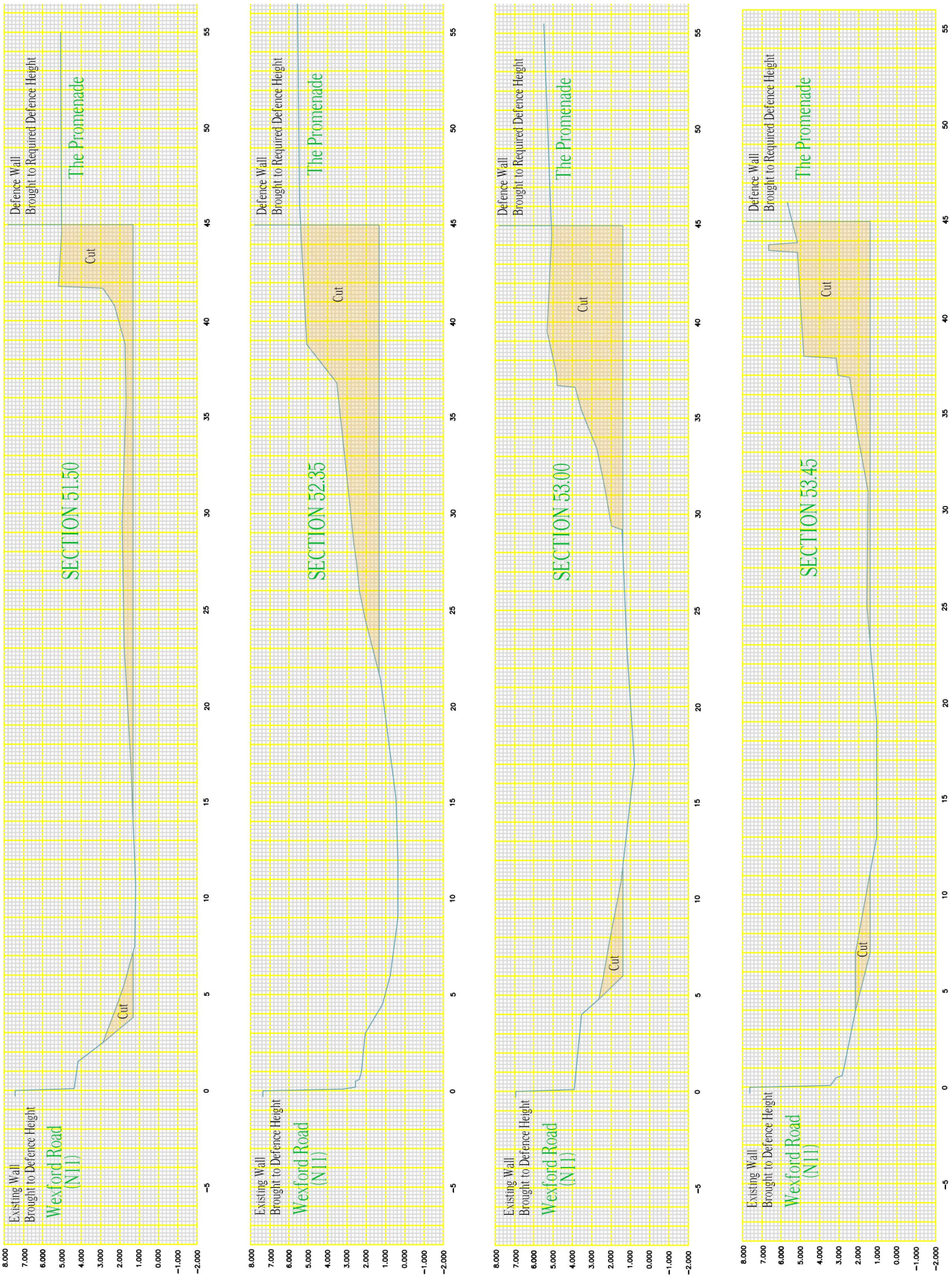


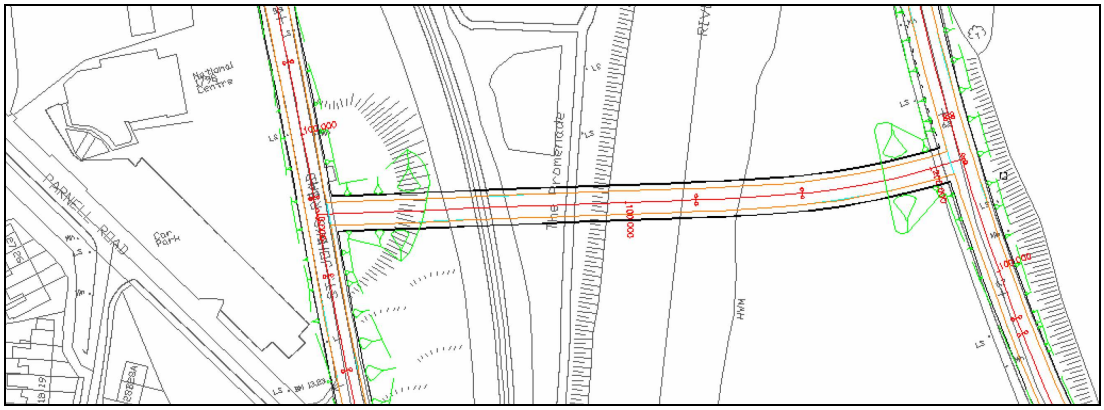
Figure 3.7 Cross Sections between Chainage 5150 and 5345



Seamus Rafter Bridge Removal / Bridge Replacement

3.4.7 Seamus Rafter Bridge at chainage 5356, would be removed completely, including any stonework, pillars, piles, etc within the river. A new bridge is to be built crossing the river near chainage 4800 some 100m downstream of the Riverside Park Hotel (Grid Reference 297260 139220 to Grid Reference 297455 139180). The location of the bridge crossing and associated road tie-in is presented in **Figure 3.8**.

Figure 3.8 New Bridge Crossing Location at Chainage 4800



3.4.8 The intended bridge design is a cable-stayed bridge, which would entail a dual-pylon structure at the eastern end within the existing meadow, as shown on **Figure 3.9**. The bridge would extend approximately 210m over the River Slaney, with no footprint within the river, as shown in **Figure 3.10** and the sketch in **Figure 3.11**.

3.4.9 Junctions connecting the N30 and the N11 at either end of the proposed bridge could take the form of a roundabout or a traffic light controlled T-junction. Further consideration at Detailed Design Phase will be required with respect to the choice and design of junction giving due consideration to traffic flows, junction size, junction capacities, possible need for realignment of existing approach roads to provide deflection angles/right turn lanes, and use of junction by pedestrians and cyclists.

Figure 3.9 New Bridge Pylon and Deck Details

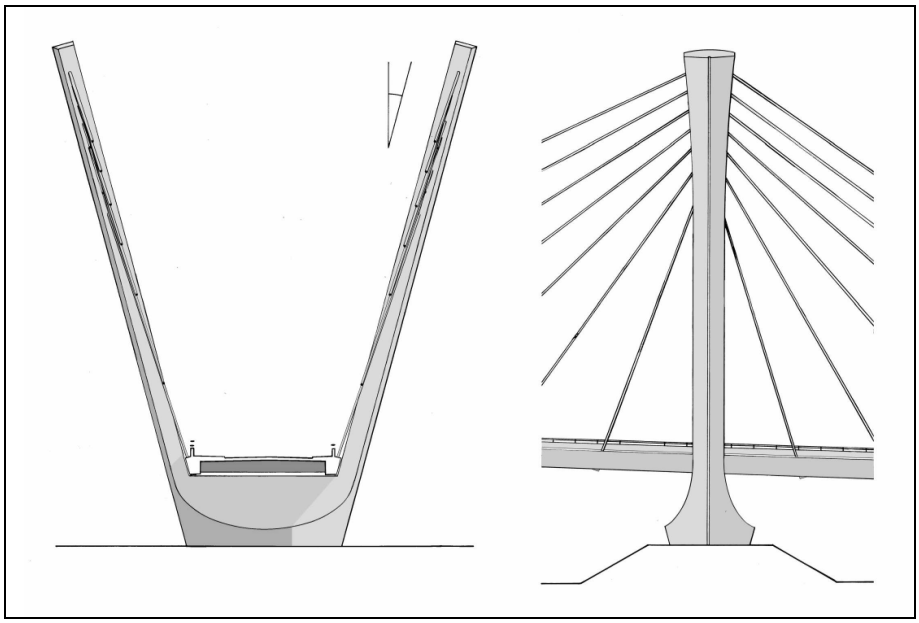


Figure 3.10 New Bridge Indicative Cross Section

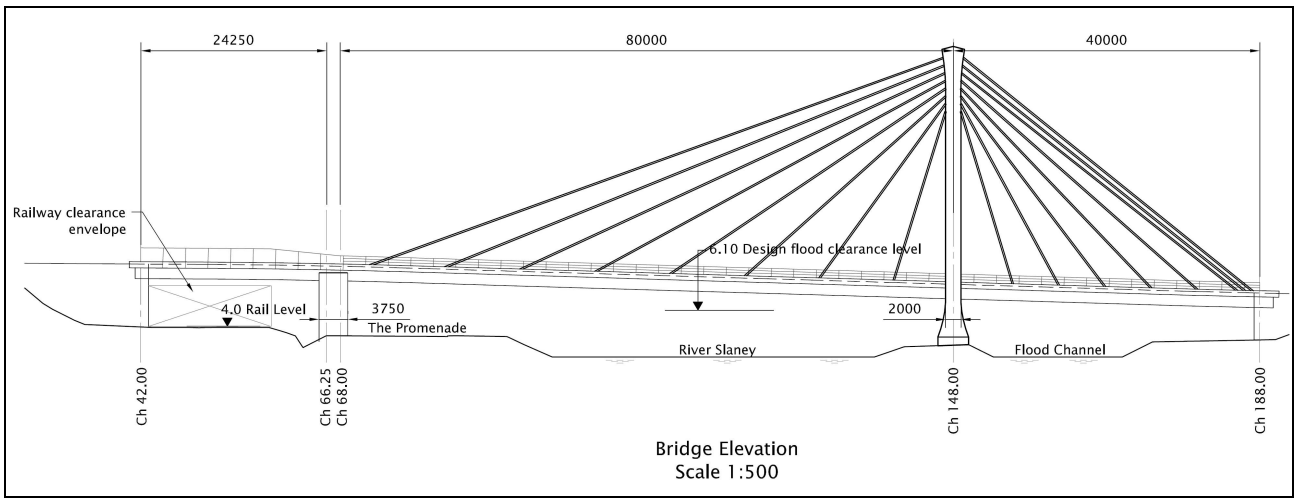
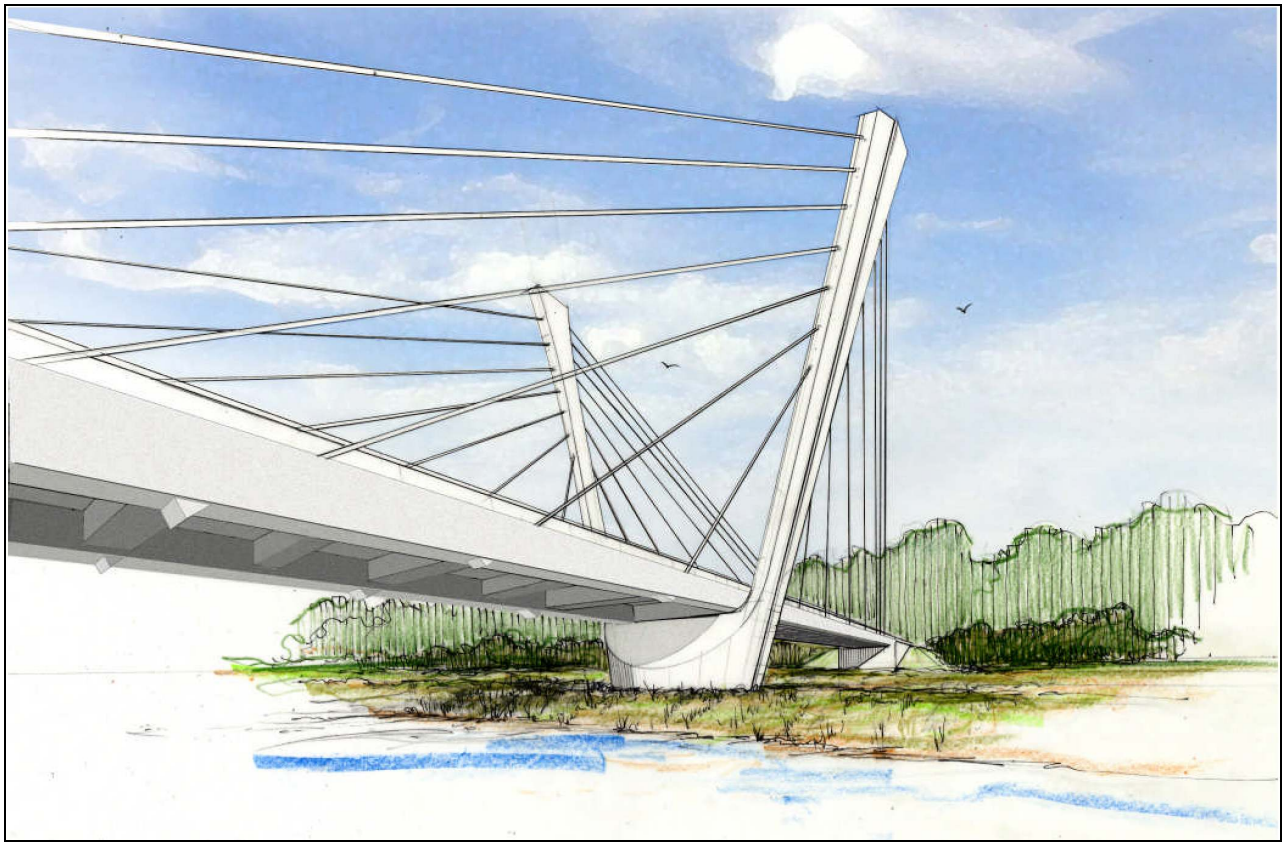


Figure 3.11 New Bridge Indicative Sketch looking from the Promenade downstream, looking from the south west to the northeast

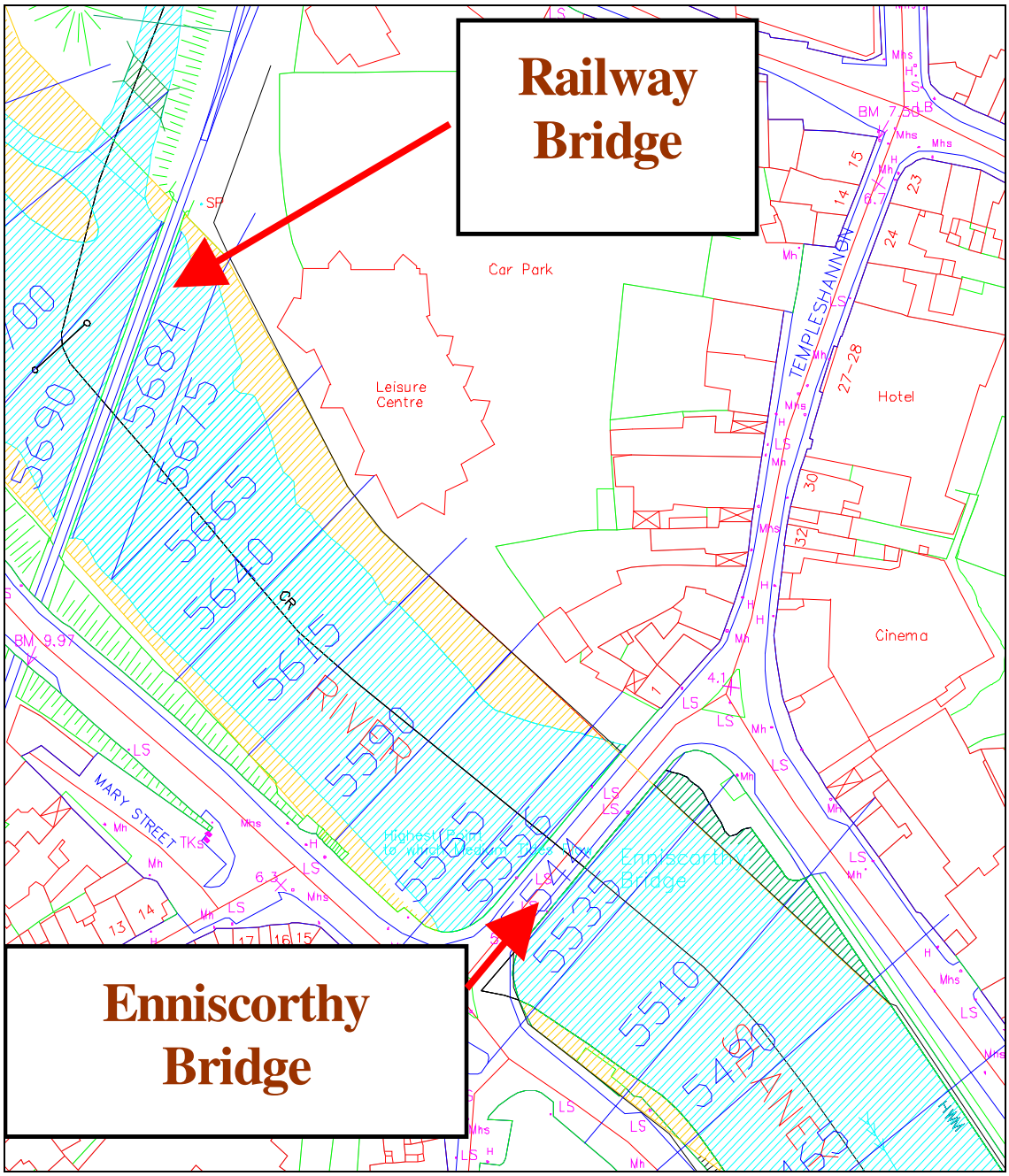


3.4.10 In addition to the new road bridge, a footbridge would be built across the River Slaney just upstream of the site of the Seamus Rafter Bridge (Grid Reference 297500 139770 to Grid Reference 297545 139800). This will ensure that no pedestrian detours are necessary following removal of the Seamus Rafter Bridge, and pedestrian access should improve. The footbridge would be approximately 4m wide, however, no design details are presently available; consequently, during the Detailed Design Phase the footbridge design and construction elements should be confirmed with Enniscorthy Town Council, and any change in the environmental effects confirmed with the ERFB and NPWS.

Seamus Rafter Bridge (chainage 5380) to Enniscorthy Bridge (chainage 5544)

3.4.11 The river would be widened by about 4m along a 45m stretch (180m^2) immediately downstream of Enniscorthy Bridge on the right bank, as shown on **Figure 3.12**. In addition, the left bank immediately downstream of Enniscorthy Bridge would extend into the river, with a stone faced pile wall, for a length of 65m (120m^2). This infill is necessary to improve flood flow conveyance resulting from the orientation of river flows under Enniscorthy Bridge through the bridge eye nearest to the left bank.

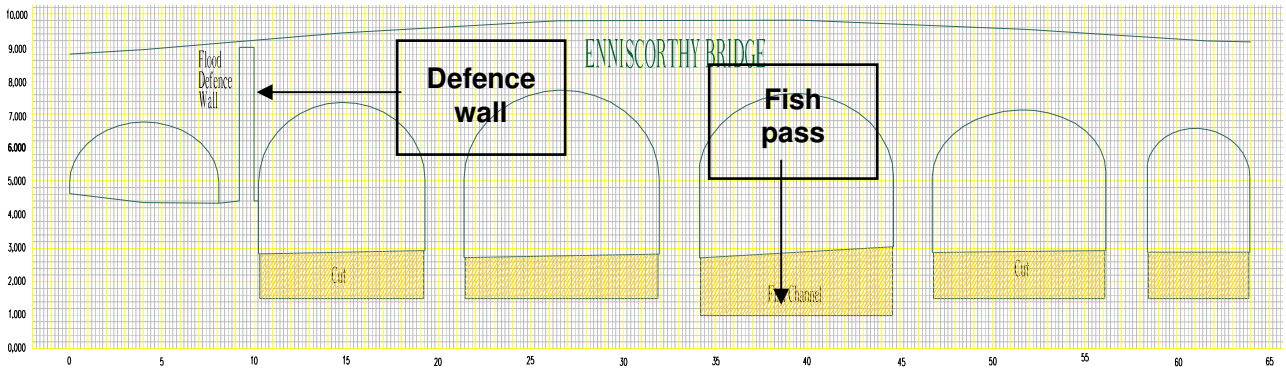
Figure 3.12 River Widening and Infill between Railway Bridge to downstream of Enniscorthy Bridge



Enniscorthy Bridge

3.4.12 The bed under Enniscorthy Bridge is 1.2m above the design riverbed, and over 2m above the downstream riverbed, which is as well as effecting flood flows also results in an obstruction to fish movement within the river particularly during low flows (i.e. in summer). As part of the scheme, the bed under the bridge would be deepened by 1.2m. **Figure 3.13** shows the depth of bed removal at Enniscorthy Bridge, including a slightly deeper eye to ensure the movement of fish during low flow conditions. As well as bed deepening works, the bridge will need to be underpinned to ensure its stability.

Figure 3.13 Bed Deepening under Enniscorthy Bridge



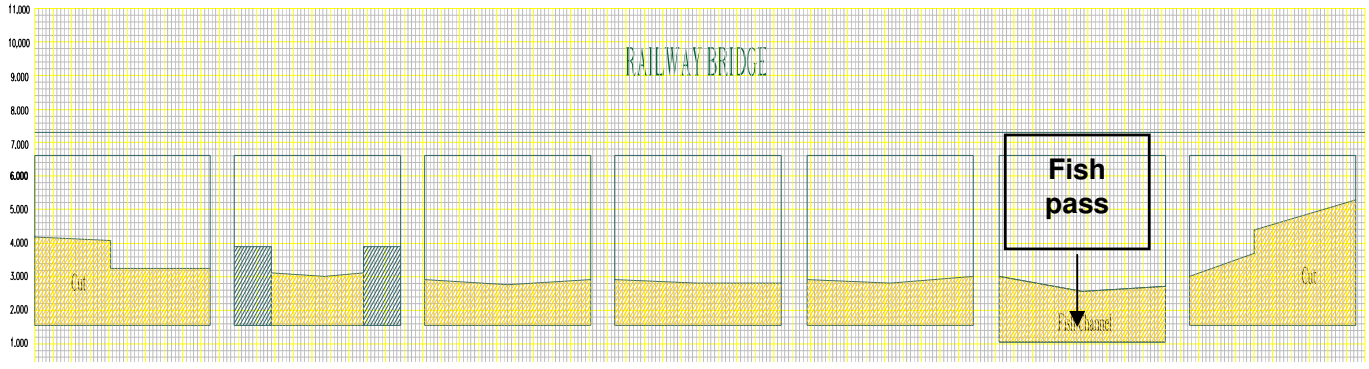
Enniscorthy Bridge (chainage 5556) to the Railway Bridge (chainage 5684)

3.4.13 The river would be widened by about 8m along this 135m stretch (870m^2) on the left bank between the Railway Bridge and Enniscorthy Bridge, and by about 2m on the right bank (120m^2), as shown on **Figure 3.12**.

The Railway Bridge

3.4.14 As with Enniscorthy Bridge, the bed under the Railway Bridge is 1m above the design riverbed, and as well as effecting flood flows can also cause obstruction to fish movement within the river during periods of low flow (i.e. in summer). As part of the scheme, the bed under the bridge would be deepened by 1m. **Figure 3.14** shows the depth of bed removal at the Railway Bridge, including a slightly deeper eye to ensure the movement of fish during low flow conditions. As well as bed deepening works, the bridge will need to be underpinned to ensure its stability.

Figure 3.14 Bed Deepening under the Railway Bridge



Upstream of the Railway Bridge (chainage 5690)

3.4.15 For 200 metres directly upstream of the Railway Bridge, the river would be widened significantly along the left bank, to create a channel width of 62m. After a 200m transition the river would be designed with a base width of 50m, which will result in widening for another 700m, as shown on **Figure 3.15**. In total around 25,000m^2 of river would be created. The bed level at these widened sections would be 0.5m above the design bed level as shown on **Figure 3.16**. This provides a berm for habitat enhancement as well as reducing flows downstream. The works along this section reduce the containment measure (wall) heights required for Island Road and provide space to build containment measures, as well as reducing flow velocities downstream.

Figure 3.15 River Widening and Infill upstream of the Railway Bridge

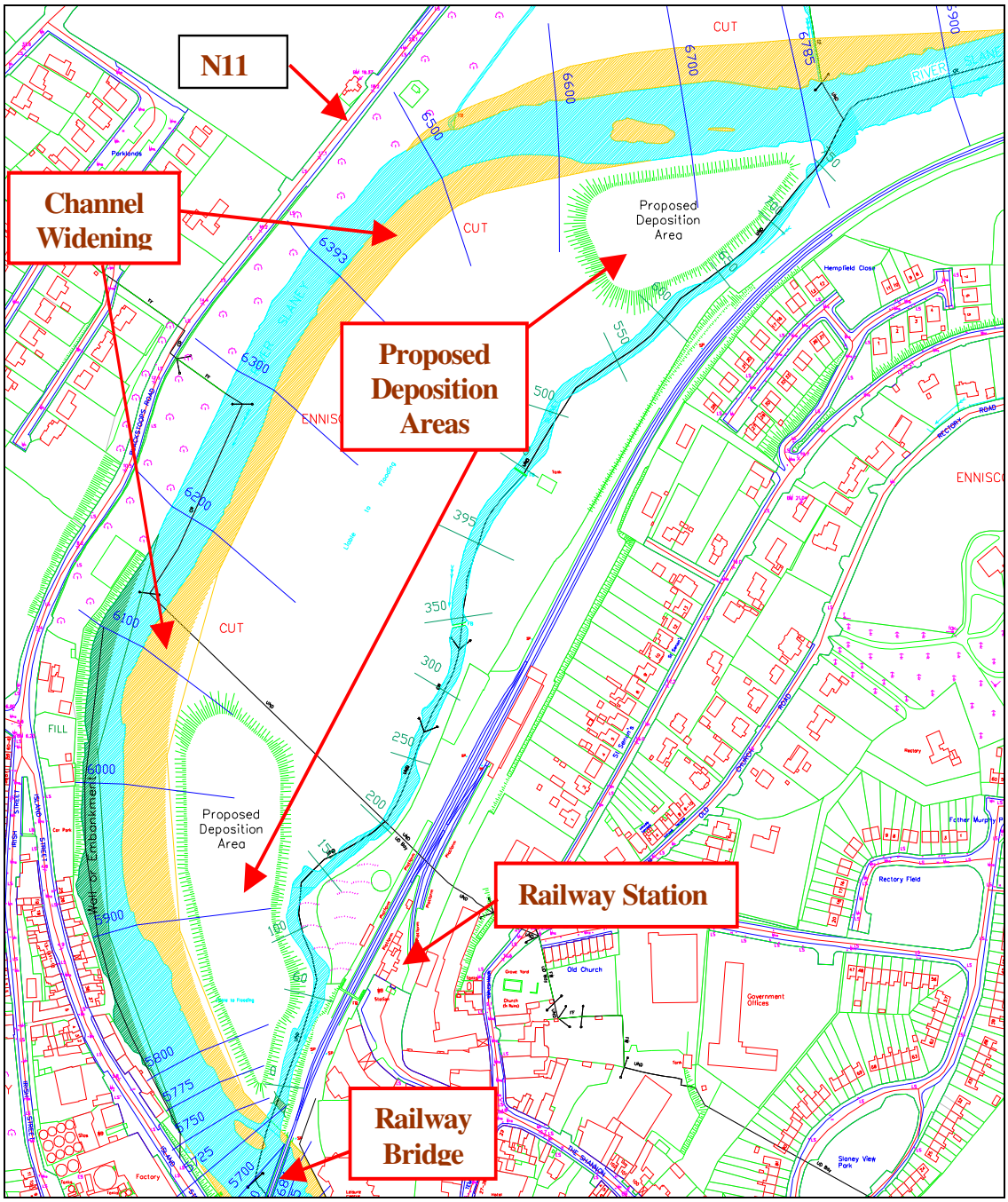
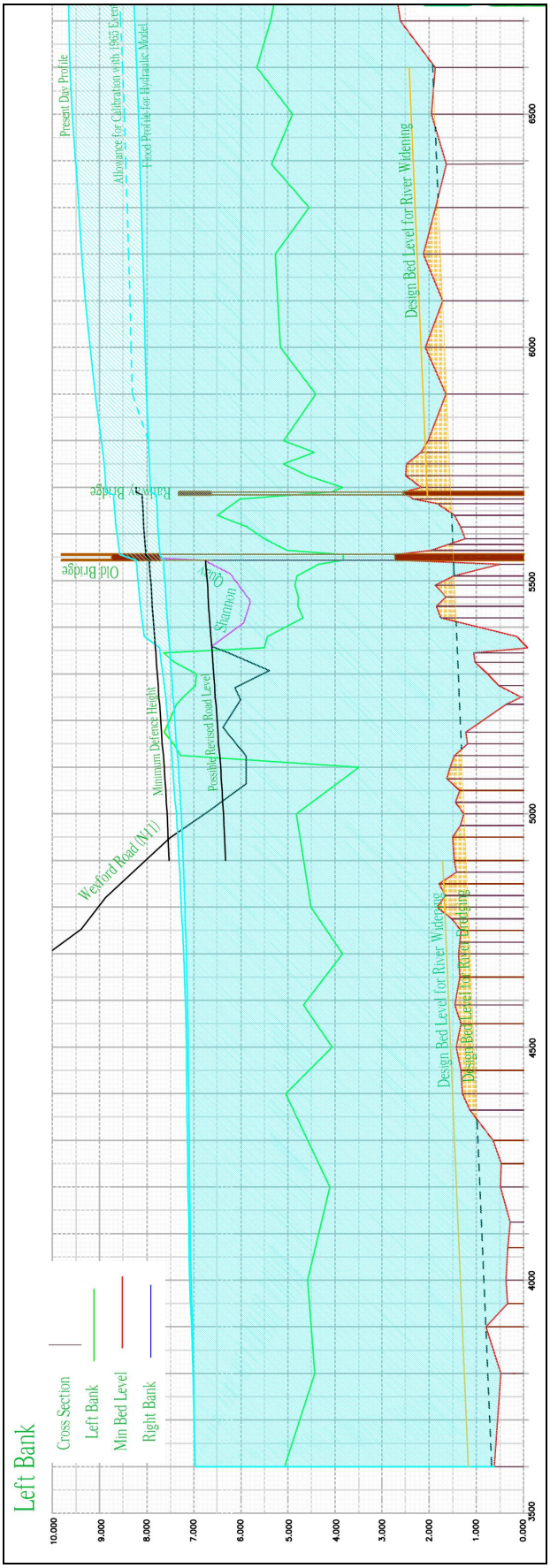


Figure 3.16 River Bed Dredge and Fill Depths in Long Section



3.4.16 On the right bank upstream of the Railway Bridge from chainage 5775 to chainage 6175 (approximately 400m) as shown on **Figure 3.15**, reclamation would take place into the river. The infill works would result in approximately 3,900m^2 of river being in-filled, offsetting the 25,000m^2 created from the widening described in **paragraph 3.4.14** above. The infill would entail the use of river bed material, as well as material from the river widening, and these would be graded up to and above the existing ground levels along this stretch.

River Bed Works

3.4.17 In addition to the widening works described earlier, lengths of the river require deepening whilst other lengths require filling, in order to provide a connected system where flows do not significantly change and result in deposition or erosion in new areas as a result of the scheme. A design river bed level has been derived from the OPW modelling work, and the cut and fill sections based on the centre of the river bed are presented in **Figure 3.16**, and summarised in **Table 3.4**.

Table 3.4 Estimated River Bed Dredge/Fill Depths

Section	Chainage	Along the centre of the river	
		Depth removed (m)	Depth deposited (m)
d/s of the Riverside Park Hotel	4750 - 4960	0.2 to 0.6	
u/s of the Hotel to Seamus Rafter Bridge	4960 – 5140	0.1 to 0.3	
	5140 - 5356		0.4 to 1.4
Seamus Rafter Bridge to Enniscorthy Bridge	5356 – 5410		0.4 to 1.5
	5410 - 5510	0.2 to 0.4	
	5510 - 5544		0.0 to 1.0
Enniscorthy Bridge to Railway Bridge	5544 - 5555	1.2	
	5555 - 5575	0.0 to 1.0	
	5575 - 5640		0.0 to 0.3
	5640 - 5680	0.0 to 0.9	
u/s of Railway Bridge	5680 - 5690	1.0	
	5690 - 6320	0.0 to 1.0	
	6320 - 6470		0.0 to 0.3
	6470 - 6550	0.0 to 0.1	
	6550 - 6610		0.0 to 0.1

3.4.18 The floodplain meadow on the left bank upstream of the Railway Bridge is under two to three metres of water during extreme flood events. Flood waters on the meadow have a shorter and more efficient overland route down to the Railway Bridge than waters that remain in the river so a considerable amount of floodplain flow takes place. The calibration process of the numeric model showed that this floodplain flow re-entering the river upstream of the Railway Bridge, at right angles to the river, damages the river's flow capacity. Reducing, or shutting off, this floodplain flow therefore increases the capacity of the river. This can be achieved by placing the river's excavated materials on the meadow close to the river. Consequently, two areas of flow deflectors will be created by building a

large berm area at the upstream and the downstream end of the meadow, as shown on **Figure 3.15**.

3.4.19 The deflectors would be raised to around 3.5m to 4m above existing ground levels at the both ends. The deflectors would be set back 4m to 5m from the widened river sections. In all, the southern deflector would cover 15,600m^2, and the northern deflector would cover an area of 9,000m^2.

Containment – Flood Walls and Embankments

3.4.20 Following the implementation of the increase conveyance works, the remaining aspect of the scheme would be the installation of flood containment measures which would take the form of walls, within the areas that are still below the design flood event height (i.e. the 1 in 100 Year event). In line with these works are landscaping and possible other works such as road raising to avoid or minimise the potential impacts of containment measures. **Figures 3.17** present the overall scheme details, in particular showing the line of the flood containment walls and embankments, and heights of the structures.

The Riverside Park Hotel to Seamus Rafter Bridge (chainage 5356)

3.4.21 On the right bank, along Promenade Road, the road would be raised by between 0.2m and 1.1m for a length of approximately 440m (see **Figure 3.17**). The greatest road raising would be in the central section of this road (chainage 5050 to 5030). The long section showing road raising heights and defence heights for the right bank of the River Slaney through Enniscorthy are presented in **Figure 3.18**. Downstream of the Riverside Park Hotel, a stone-faced flood wall extending 130m will tie in the defences near the railway line (see **Figure 3.17**), the wall will then tie in to a flood embankment that would cross the Promenade Road and curve eastward to reach the river, then turn north to run parallel to the river. The embankment would be approximately 90m in length. Alongside the hotel, the embankment will then tie in to a stone faced wall, which will then run along the edge of the river on top of the raised road level for 240m up to Seamus Rafter Bridge. The wall would be 1.2m above the existing or raised ground levels.

3.4.22 On the left bank, the N11 would be raised by between 0.1m to a maximum of 1.2m; though generally around 0.5m, for approximately 330m (see **Figure 3.17).** On the river side of the road, a stone-faced flood wall would be built for a distance of approximately 400m before it ties in to the flood wall along Shannon Quay. The wall would be 1.2m high above the existing or raised road level (see **Figure 3.18**).

Seamus Rafter Bridge (chainage 5380) to Enniscorthy Bridge (chainage 5544)

3.4.23 On the right bank, along over two thirds (or around 110m) of Abbey Quay, the road would be raised by between 0.2m and 0.8m (see **Figure 3.17**), though predominantly around 0.5m, as shown on **Figure 3.18**. Alongside the river, a stone-faced flood wall would be built for a distance of approximately 150m before it ties in to the flood wall at the location of the removed Seamus Rafter Bridge, or with the road as it rises before Enniscorthy Bridge at the upstream end. The wall would be 1.2m high above the existing or raised road level.

Figure 3.17 Overview of Containment and Other Scheme Details

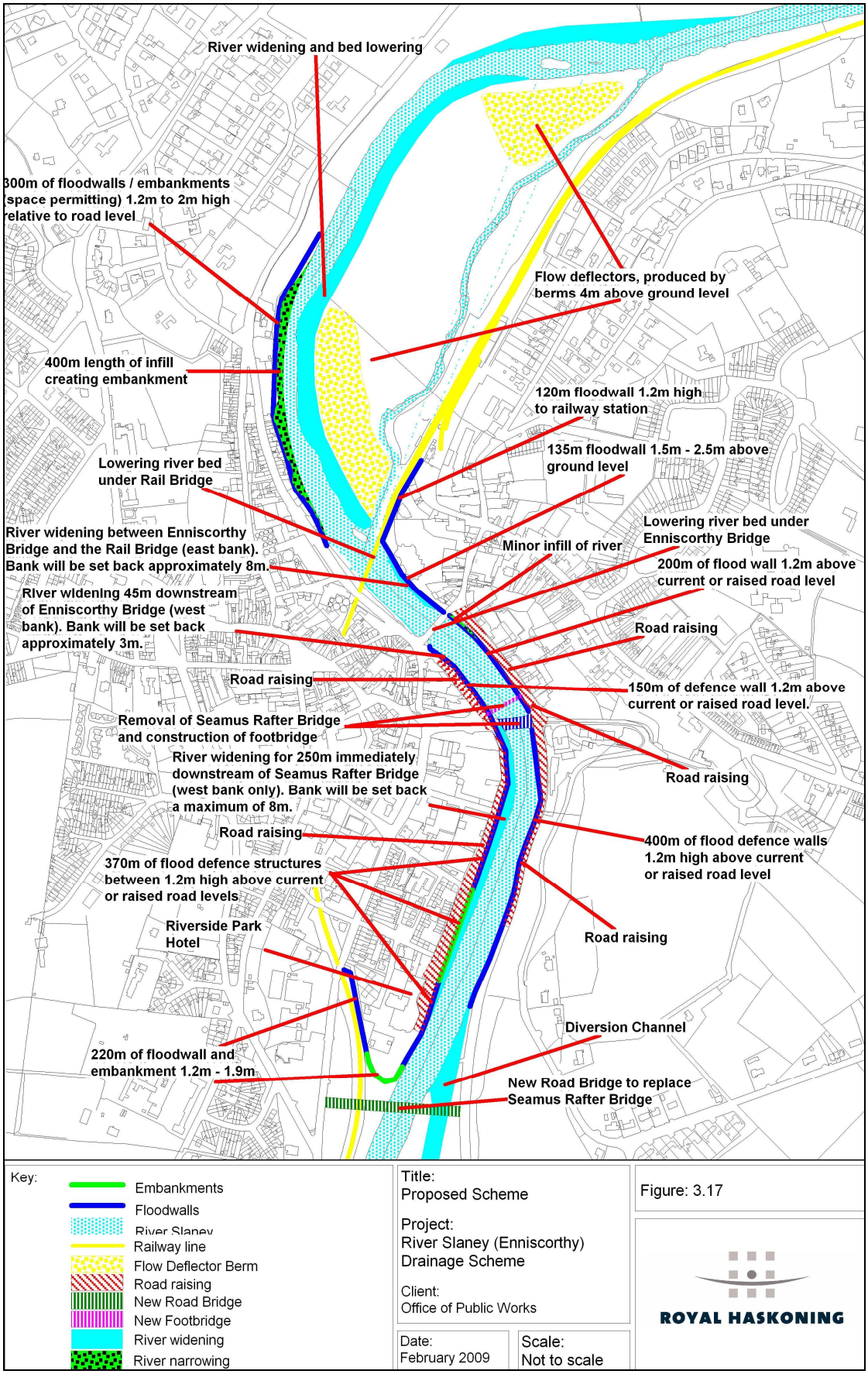
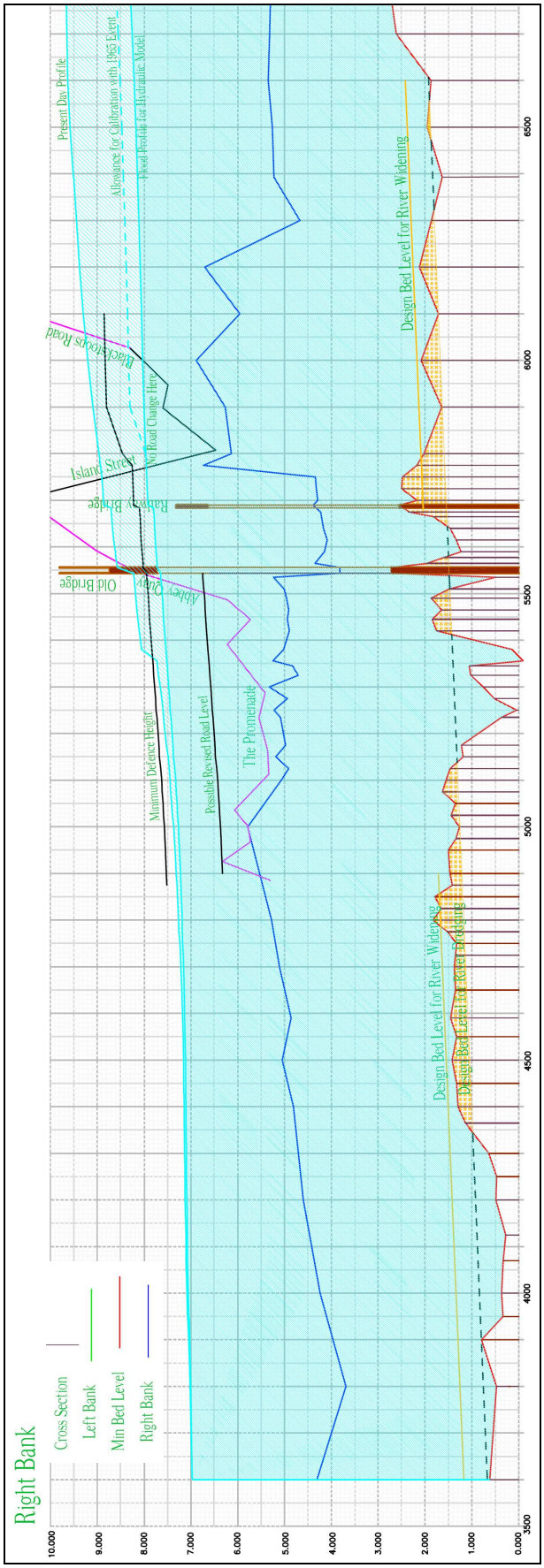


Figure 3.18 Right Bank Long Section of Scheme through Enniscorthy



3.4.24 From 70m downstream of Enniscorthy Bridge to Enniscorthy Bridge the defence wall will be built from the design channel bed level and is 6.5m in height (see **Figure 3.18**). This is between 1.3 and 1.7m higher than Shannon Quay road. The wall will be built up alongside the river, and the adjacent path will be raised to a level 1.2m below the wall crest. Consequently, the raised ground between the riverside wall and the N11 along Shannon Quay would be at or approximately 0.5m higher than the road. It is likely that during the Detailed Design Phase a slope can be created between the reinstated footpath and the road so that there is no significant height difference. This would also avoid any disturbance to the trees that run along Shannon Quay.

Enniscorthy Bridge (chainage 5556) to the Railway Bridge (chainage 5684)

3.4.25 No containment is required along the right bank upstream of Enniscorthy Bridge to the Railway Bridge due to existing high walls or high roads. On the left bank alongside the Leisure Centre, a river wall would tie in to the right of the left bridge eye (see **Figure 3.13**) and extend for a distance of 135m before it tied in to the Railway Bridge (see **Figure 3.17**). Beyond that a 1.2m high wall should run from the Railway Bridge to the Railway Station where it would link up with the car park, which itself should be raised by 0.3m over an area of about 120m^2.

Upstream of the Railway Bridge (chainage 5690)

3.4.26 Along the right bank upstream of the Railway Bridge for a distance of 300m, walls and embankments will be constructed between 1.2m and 2m above the existing road level. These heights will actually be between 1.8m and 2.3m above the ground level at the back of residential properties. Along the stretch of residential properties (as shown on **Figure 3.12** and **Figure 3.17**) some land reclamation will be carried out to provide space for river walls and embankments. The wall would be stone-faced.

3.5 Project Implementation

3.5.1 The following provides initial detail and description of the works to be undertaken as part of the construction for the proposed scheme. River works and containment wall/embankment construction are well understood and relatively simple tasks to carry out. Consequently, the construction equipment and plant required for these stages of works are limited. The complex works occur when the bridge works are being carried out, particularly the new bridges, and removal of the Seamus Rafter Bridge.

Cable Stayed Bridge Construction Detail

3.5.2 Construction would commence with the pylon structure on the east side of the river. Pre-fabrication of the pylon components will enable sections to be lifted from ground level, minimising work needing to be carried out at height (and so providing a health and safety benefit). A concrete alternative, however, using moving formwork, remains a viable solution, and would depend on the contractor appointed to undertake the construction works.

3.5.3 For each stage of deck construction, pre-cast edge units will be lifted into position (using a balanced cantilever sequence of erection), connected to the relevant cable stay and temporarily stressed longitudinally to the preceding section (utilising the cable stays in part where appropriate). A formwork gantry will then be positioned to cast the transverse beams which will be post-tensioned prior to in situ construction of the deck slab. Additional pre-stress would later be applied to the edge beams to resist live load effects, and forces in the cable stays adjusted.

3.5.4 The separate structure over the railway could be constructed in tandem with the arch structure. Either one or two night-time possessions (or one weekend possession) of the railway will be required to install the pre-cast beams over the railway using mobile cranes. In order to minimise the risks to the operation of the line, cantilevering formwork and side protection for parapet construction would be fixed to the beams prior to erection, whilst participating formwork in the form of "OmniaTM" planks (or similar) would be lifted in during a subsequent possession once the erection of the pre-cast beams is complete. The beams would be braced together prior to deck construction. It is envisaged that pre-cast units may be employed to facilitate construction of the stringcourse beams.

3.5.5 A construction programme of 20 months has been assumed for outline costing purposes.

New Footbridge Bridge

3.5.6 Prior to the removal of the Seamus Rafter Bridge, the new footbridge would be built, which would be built using a crane, along with a piling rig. Piling would be short-term in nature due to the very small size of the structure, and may even entail rotary piling.

Seamus Rafter Bridge Removal

3.5.7 Removal of the Seamus Rafter Bridge would likely require a crane, trucks to remove the bridge material to recycling plants (for the metal), and for crushing for the concrete. A breaker may be required for the removal of the base structure of the bridge foundations.

Containment Wall and Embankment Works

3.5.8 The wall and embankment works are expected to be low key and restricted to small working areas at any one time. Work would progress along the walls, with the embankment works to be undertaken when the river widening and dredging/deposition works take place. The equipment likely during the wall and embankment works would be a tipper truck, a lorry (for movement of larger amounts of material), a JCB and a crane. As the works would progress in small stages, the amount of material transported by road on any day would be very small, with rock for the wall facings and concrete being the key materials to be transported.

River Widening, Narrowing, and Excavation Works

3.5.9 The various in-river works would be restricted to the months of May to October to minimise the impact to fish within the river. The works would commence from the downstream end, and work their way upriver. The works would require the use of a JCB, and a dumper truck and a lorry. The lorry would transport material for the most, while the tipper would be used in restricted areas. First the JCB would drag material to form a causeway, working its way upriver. Then when it had achieved the full length of the river works it would then remove the material to the design bed level. The tipper or lorry would then move the excess material to the stretches where the material is required to raise the river bed. The excess materials not used for narrowing parts of the river, or for deepening the river, would be used to create the flow deflectors in the meadows upstream of the railway bridge. On the whole the material requirements (see **Table 3.5**) are fairly small, with the majority of material being used close to its current position.

Land-use Requirements

3.5.10 An accurate indication of the likely working area cannot be determined at this stage, but would be identified during the Detailed Design Phase. However, the majority of works would take place very close to or within the river.

Resources used during Construction

3.5.11 **Table 3.5** presents the estimated material volumes to be dredged, deposited or re-used during various aspects of the scheme construction. These shall be confirmed in the Detailed Design Phase. Review of the impacts and methods for using and disposing of these volumes will need to be undertaken, and a strategy agreed with the Environmental Protection Agency (EPA), Wexford County Council, and Enniscorthy Town Council, during the Detailed Design Phase.

Table 3.5 Estimated River Bed Dredge/Fill Volumes 40m

Section	Chainage	Along the centre of the river	
		Volume removed (m^3)	Volume deposited (m^3)
Diversion Channel		**145,000**	
d/s of the Riverside Park Hotel	4750 - 4960	3,360	
u/s of the Hotel to Seamus Rafter Bridge	4960 – 5140	1,440	
	5140 - 5356		7,776
Seamus Rafter Bridge to Enniscorthy Bridge	5356 – 5410		2,052
	5410 - 5510	1,200	
	5510 - 5544		680
Enniscorthy Bridge to Railway Bridge	5544 - 5555	528	
	5555 - 5575	400	
	5575 - 5640		390
	5640 - 5680	720	
u/s of Railway Bridge	5680 - 5690	400	
	5690 - 6320	12,600	
	6320 - 6470		900
	6470 - 6550	160	
	6550 - 6610		120
Total River Bed Works	**4750 - 6610**	**20,808**	**11,918**
Bank widening – RPH to SRB		3,940	
Bank widening – SRB to EB		630	1,560
Bank widening – EB to RB		4,320	
Bank widening – u/s of RB		90,000	22,400
Total bank widening/narrowing		**98,890**	**23,960**
Road Raising – d/s SRB			5,000
Road Raising – u/s SRB			1,500
Total Road Raising		**0**	**6,500**
Upstream Deflector Berms		**0**	**98,400**

Anticipated Work Programme

3.5.12 Excavation within the river shall be confined to months acceptable to the Central Fisheries Board to minimise disturbance. Much of the protection work on existing structures and, possibly, the construction of most of the new defence walls can only be carried out during low to medium river water level conditions, in particular during ebb tide. Working during low to medium river flow depths is also an important Health and Safety requirement. Similarly, hours of work will, generally, be confined to hours of daylight except in exceptional cases.

3.5.13 The main river excavation works are upstream of the town. Works, however, could result in localised wide shallow flow conditions unfavourable for fish. Where necessary, a 'Fish Channel' may be excavated to maintain a sufficient depth of flow for fish movement.

3.5.14 Rehabilitation measures such as landscaping may begin in the second year. Rehabilitation works within the river may continue an additional year, i.e. after works have been completed, should such delay allow an improved understanding of the revised river movements that then enables a tailoring of these works.

3.5.15 The proposed scheme may be completed in three work packages over three years (or possibly four), as follows:

- Construction of the new bridge plus its necessary access roads and the removal of the existing Seamus Rafter Bridge. This is likely to form a separate contract and, as it mainly avoids the mobilisation areas of the other two packages of work, it is likely that they can be carried out in tandem during the first year (or two) with minimal shift from an optimal work schedule. The new bridge must be constructed before the existing Seamus Rafter Bridge is removed so that disruption to both the N11 and local traffic is kept to a minimum. Work on the new bridge, therefore, should begin in the first year;
- Construction of the gravel/debris trap and diversion channel. Improvements to the existing gravel trap (about 1km upstream of the Railway Bridge) and rock protection to the riverbed immediately downstream of it will be carried out in the first year to ensure that upstream river efficiency (due to the ongoing scheme works) does not result in significant erosion. The diversion channel may be constructed whenever it suits the bridge contractor;
- Construction of the new double sewer pipe (and ancillary works) from Seamus Rafter Bridge to the car park downstream of the Riverside Park Hotel. This is also likely to form a separate contract. It is possible that the flood-defence wall along this area could be included in this contract; this need to be agreed with the relevant parties and will be decided upon during the Detailed Design Phase; and
- Construction of most defence walls. The bulk of structural work will be carried out in the first and second years while stone facing the structures may be completed in the third and final year. The N11 walls along the left (east) bank could, however, be left to the fourth year.

Description of the Operation of the Project

3.5.16 Currently, the design of the fish pass through the Diversion Channel is not defined. However, it is expected that the volume of water required for the fish pass need not exceed 0.5m^3/s. The flow volume can be controlled through stepping and other design elements that will need to be determined in the Detailed Design Phase, during which it will need to be reviewed against the impacts identified in this EIS, and consultation carried out with ERFB and NPWS to confirm the avoidance or minimisation of potential impacts.

3.5.17 At present, large floods inundate parts of the town. Floods up to the 100 Year Design Flood, however, will no longer do so after the scheme. This means that part of the flood plain will be shut off from floodwaters. In real terms this area is not substantial when compared with the overall flood plain both upstream and downstream of the town. Still, shutting it off will have some effect (however small). The primary concern relates to the peak level of future floods because the effect will be most noticeable at the peak and because it is only necessary for the peak to flood property for damage to occur. A first order approximation of the effect on flood water levels downstream of the proposed Enniscorthy Drainage Scheme is as follows:

1. In examining the effect on flood peak levels it is not necessary to consider the overall volume of storage being denied to the floods because, under the present day, undefended condition, that volume is being filled up as the flood level rises; in other words, the volume is not available by the time the flood peak arrives. So, the problem relates to the plan area of the enclosed space. The total area is about 12 hectares and the last 0.1m rises up to the flood peak in 2 hours (based on the hydrograph of the November 2000 event). The volume denied to the flood peak is 0.1 x 12 hectares (i.e. 12,000 cubic metres) and as this fills in 2 hours the average flow rate into the area is therefore 1.67m^3/s;
2. With a flood alleviation scheme in place, this area is denied to the flood so this flow rate of 1.67m^3/s must be added to the flood peak. At Edermine Bridge, the 100 Year design flood would increase from 630m^3/s to 631.67m^3/s (i.e. 0.26% or about quarter of 1%). Applying the estimate to the present day Rating Curve at Edermine (this relates river flow to water level) shows that the 100 Year flood level would increase from 5.639m OD to 5.646m OD (Poolbeg) (i.e. it has increased 0.0066m or 6.6mm); and
3. While the proposed works for the Enniscorthy scheme reduces the available area of flood plain to some extent, it is considered that this will only have a very small effect on the flow regime downstream.

3.5.18 In extreme floods, the water levels upstream of the proposed scheme would be lower by up to 1m. It is expected that within a kilometre upstream of the north extent of the scheme, this reduction in water levels would not be noticeable. There would be no significant reduction in water levels outside of flood events (i.e. during low or normal flows).

3.5.19 The proposed new bridge is approximately 600m downstream of the existing Seamus Rafter Bridge at the southern fringe of Enniscorthy town and would connect the Saint John's Road (N30) to the Wexford Road (N11), as shown on **Figures 3.13** and **3.17**. At present the junction details are not defined, however, they could take the form of a roundabout or a traffic light controlled T-junction. The details of junction design will be determined during the Detailed Design Phase, to ensure the junctions give due consideration to traffic flows, junction size, junction capacities, possible need for realignment of existing approach roads to provide deflection angles/right turn lanes, and

use of junction by pedestrians and cyclists. These details will be designed and agreed with the National Roads Authority, Wexford County Council, and Enniscorthy Town Council.

3.5.20 At the junctions between the bridge, N30 and N11, a ghost island junction, traffic signals or roundabout will likely be necessary to facilitate high right-turn volumes expected at each junction. Detailed analysis would be required to inform the decision on which junction form is the most appropriate at either side of the bridge proposals and its terminal connections with the N11 to the east and the N30 to the west.

3.5.21 **Figure 3.19** presents the new road network and flow routes with the new bridge in place. Traffic currently travelling south on the N11 and turning right on Seamus Rafter Bridge would travel 600m further south and turn right onto the new bridge, then travel across the bridge before turning either left or right onto the N30. Traffic which is currently travelling north on the N11 and turning left onto Seamus Rafter Bridge would turn left approximately 600m earlier onto the new bridge, travel across the bridge, and turn before turning either left or right onto the N30. The greatest increase in any journey would be approximately 1.2km.

Maintenance

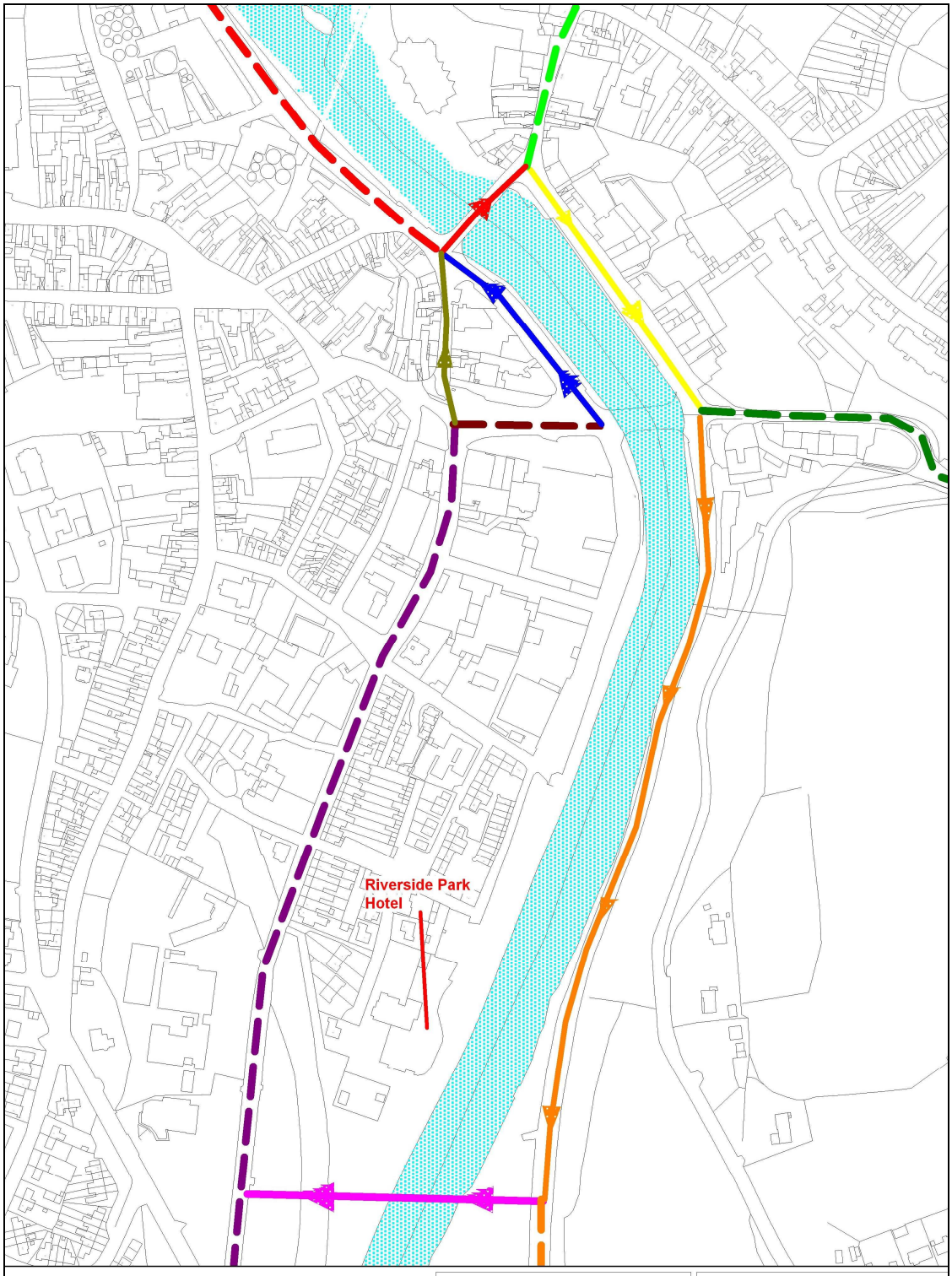
3.5.22 Currently, there are no details of the maintenance measures that would take place. From the hydrological study it appears that there would be a limited likelihood of river bed works, as the scheme design is such that only material in the sediment deposition area 1.5km upstream of the works would need to be removed on an irregular basis. The timing, duration, and scale of the works are not known, however, they would be of a much reduced scale to those of the proposed scheme construction. Once the details of the maintenance requirements are known during the Detailed Design Phase, a review of potential impacts and necessary methods and timing of the works must be undertaken, and discussion and agreement carried out with the EPA, Wexford County Council, Enniscorthy Town Council, the ERFB, and the NPWS, prior to scheme construction to confirm the maintenance plan.

3.5.23 The following maintenance activities are envisaged for the bridge:

- Bearing replacement;
- Joint replacement;
- Cable/hanger replacement;
- Resurfacing and re-waterproofing of deck;
- Repainting of steelwork (minor and major maintenance);
- Refurbishment of drainage and discharge systems; and
- Replacement road markings, and damaged sections of parapet.

3.5.24 It is also expected that an inspection programme will be undertaken in accordance with the National Roads Authority Design Manual for Roads and Bridges. Principal Inspections are assumed to take place at 6-year intervals. Detailed inspections and maintenance details will be identified during the Detailed Design Phase. Overall, there would be minimal activity and the likely disturbance would only be to traffic during the period of maintenance.

Figure 3.19 Altered Traffic Routes with New Bridge and Proposed Scheme



Key:

Dotted lines denote two-way roads

Solid lines indicate one-way traffic flow, and arrows point in the direction of flow.

Title:
New Road Network

Project:
River Slaney (Enniscorthy) Drainage Scheme

Client:
Office of Public Works

Date:
February 2009

Scale:
Not to scale

Figure: 3.19

ROYAL HASKONING

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4 THE ENVIRONMENTAL IMPACT ASSESSMENT PROCESS

4.1 Introduction

4.1.1 This section describes the EIA process undertaken for the proposed drainage scheme in the Enniscorthy area of the River Slaney catchment in County Wexford.

4.1.2 EIA is a tool for systematically considering and assessing the potential impacts of a proposed development on the environment. The process of EIA is broadly summarised below:

- Screening (determination as to whether the development requires EIA);
- Scoping (determination of the issues that should be addressed within the EIA process);
- Preparation of the EIS (see below);
- Submission of the EIS and formal consultation of statutory bodies and interested parties (includes general public).

4.1.3 Broadly, the EIS contains the following information:

- A description of the proposed scheme and alternative options considered by the developer;
- A definition of the study area for the EIA;
- A description of the existing (baseline) environment that the proposed scheme has the potential to impact (both directly and indirectly);
- Prediction of potential impacts (both during construction and operation) on the existing environment and assessment of their likely significance;
- A description of any mitigation measures that would avoid or reduce potential impacts; and
- A non-technical summary. This document is a summary of the EIS in non-technical language and forms a separate document to the main EIS.

4.1.4 The following subsections describe how this process has been undertaken for this development.

EIA Directive and Guidance

4.1.5 The EIA was carried out in accordance with the requirements of EC Directive 85/337/EEC, as amended by EC Directive 97/11/EC and 2003/35/EC, on the effect of certain public and private projects on the environment. These directives have been incorporated into Irish legislation by the implementation of the European Communities (Environmental Impact Assessment) Regulations 1989 (SI No. 349 of 1989), as amended by the European Communities (Environmental Impact Assessment) (Amendment) Regulations 1998 (SI No. 351 of 1998) and the European Communities (Environmental Impact Assessment) (Amendment) Regulations 1999 (SI No. 93 of 1999), and the European Communities (Environmental Impact Assessment) (Amendment) Regulations 2000 (SI No. 450 of 2000).

4.1.6 The EIS has been prepared with regard to the Environmental Protection Agency's '*Guidelines on the Information to be Contained in Environmental Impact Statements*' (EPA, 2002) and the '*Advice Notes on Current Practice (in the preparation of Environmental Impact Statements)*' (EPA, 2003).

4.2 Screening

4.2.1 Under the Arterial Drainage (Amendment) Act, 1995, the OPW is required to submit an EIS assessing the impacts upon the environment that the flood relief proposals may have.

4.3 Constraints and Scoping

4.3.1 A Constraints Report (Posford Haskoning, 2003) was produced in September 2003 and submitted to the OPW. The report was based on consultation with statutory consultees, a Public Information Day, and collection of a range of environmental and related data and information. The key constraints highlighted in this report were:

- **Potential habitat loss of protected species**
  - There is the potential that the study area may contain habitat and habitat features suitable for protected species such as otters. Flood alleviation options such as floodwalls may result in the loss of habitat features close to the river that are important to the otter, including ash and sycamore tree species (preferred den sites).
  - The study area is also known to support two important aquatic plant species (short-leaved water-starwort and stream water crowfoot). Short-leaved water-starwort is protected under the Flora Protection Act, 1999 and stream water crowfoot is one of the species listed within the cSAC designation as representative of floating river vegetation (listed on Annex I of the EU Habitats Directive and part of the Slaney Valley cSAC designation). Any works in areas known to support these species could violate the respective protection afforded to each species, also in-river works could alter the necessary hydro-dynamics and hydrochemistry required for the growth of these aquatic species.

- **Impact on fisheries and angling**
  - The construction of floodwalls could lead to a loss of fishing access in places. Downstream of Enniscorthy Bridge is particularly popular because the fishing is free here. Any requirement for a fish pass would also lead to a loss of fishing access within the study area.
  - Any in-channel works will need to be timed outside of the ERFB's own in-river working restriction times (October – April).
  - ***In recent years the Slaney has been closed to both commercial and rod and line fishing for salmon. Although there is unlikely to be any impact on salmon angling at present, the closures are reassessed on a yearly basis. As such the river may open to angling in the foreseeable future and the impact assessments below take this consideration into account.***

- **Alteration of flow regime (geomorphology)**
  - Channel alteration, through river excavation, will inevitably result in changes to the flow regime. Any alteration in flow regime may have a knock-on effect to the fisheries resource, affecting both angling (commercial and recreational) and otters.

- **Impact on landscape**
  - The construction of any floodwalls or embankments has the potential to impact upon a number of visual receptors, including designated tourist routes and viewpoints, roads, bridges and residences/hotels/amenities etc. These could also impact upon the overall character of the landscape (e.g. impact upon sites and monuments), conservation features such as wet woodland and certain socio-economic related values such as angling and tourism.

- **Impact on Recorded Monuments**
  - There are a number of Recorded Monuments and Protected Structures listed throughout the study area. Of these, Enniscorthy Town itself is the most obvious Recorded Monument that has the potential to be affected. Works to any of the bridges, including dredging and associated underpinning works would require specific Recorded Monument consent. Also works that will impact upon the visual setting of the town, such as floodwalls, again will require specific consent.

- **Tourism**
  - A change in river views, if floodwalls were constructed, may not be fully supported by people whose livelihood depends on the town attracting tourists.

- **Local community**
  - Consultation has shown that many residents in areas, susceptible to flooding, favour relocation rather than flood containment, commenting that development within the floodplain has led to the current flooding problems.

4.4 Data Collection

Existing Baseline Data

4.4.1 Data were collected from a number of sources during the EIA process. These were predominantly published sources as well as information from residents and other interested groups and parties within the study area.

Environmental Surveys and Investigations

4.4.2 The following primary surveys were undertaken for the EIA:

- Phase 1 Habitat Survey;
- Callitriche Survey; and
- Mammal Survey.

4.5 Consultation

4.5.1 A number of phases of consultation have taken place throughout the development of the proposed scheme. An initial consultation was held in 2003, which involved contacting some statutory consultees and relevant organisations, a summary of responses are provided in **Table 4.1**. **Appendix 2** presents the list of consultees and a copy of the consultation letter and responses.

4.5.2 A Public Information Day was held on 29th May 2003 at the Riverside Park Hotel. The purpose was to seek the initial views and comments from the public and interested organisations of the key issues that they felt the flood relief study should address. Exhibition boards were on display outlining the flooding problem describing the constraints study and providing examples of options. A brochure and questionnaire were also available. Approximately 75 people attended the day and **Table 4.2** summarises the general responses received, whilst **Table 4.3** summarises responses to the questionnaire. Details of the Public Information Day are presented in **Appendix 3**.

Table 4.1 Consultee Responses

Consultee	Response
Bird Watch Ireland	BWI hold winter bird counts datasets for the Slaney between Enniscorthy and Ferrycarrig, including 5 year summary tables for the stretch between Edermine Bridge and the River Urrin.
Duchas (Heritage)	Supplied details of Recorded Monuments within vicinity of Constraints Study Area.
Eastern Regional Fisheries Board	• ERFB supplied information relating to fish species and life stages of each species that are present within the Study Area. They also highlighted sensitive times of year for each species. • The ERFB is concerned that works undertaken could affect Shad spawning sites typically at the freshwater/saline transition. • The Board also feels that the commercial eel fishermen that fish near to Edermine Bridge should be consulted in relation to any proposed works.
Environmental Protection Agency	• The EPA drew attention to two of their published documents 'Advice Notes on Current Practice in the Preparation of Environmental Impact Statements' and 'Guidelines on the Information to be Contained in Environmental Impact Statements'. In relation to possible constraints, the EPA drew attention to its published reports for general water and air quality that are available online. • The EPA lists the following organisations as sources of information: relevant fisheries board, Dúchas, The Heritage Service, and National Parks and Wildlife. • Supplied details of the automatic water level recorders maintained in the Slaney catchment.

Table 4.2 General Responses from Visitors during the Public Information Day

Area of Interest	Comments
General	• Most visitors recognised the importance of solving the flooding problem and felt that other issues that they see as important (e.g. fishing, landscape, tourism including navigation) are secondary to the flooding problem. • Previous aggregate dredging industry in Enniscorthy was highlighted as controlling any low flow problems. Sand and gravel were dredged from the river and used in the building trade. At that time, there were no problems associated with low summer flows or large scale winter flooding. • Almost all visitors highlighted the new bridge (Seamus Rafter Bridge), as a structure that was seen to exacerbate the flooding problem. • Residents with river views from their properties would be disappointed if these were lost due to the building of floodwalls etc.
Fisheries	• Timing of in-river works must avoid sensitive times i.e. migration and spawning runs. • Any dredging works should not lead to the formation of impassable barriers. Already during low flows there are large areas of exposed sandbanks and the lowering of the river channel in places may accentuate these exposed areas effectively creating in-stream barriers that would disrupt migration and spawning runs. Further to this, if a fish pass were then incorporated to overcome these areas it would then be illegal to fish within 100m of it causing problems to anglers. • Some of the exposed sandy areas are utilised by spawning lamprey. If there were measures put in place to increase in-river flows then these areas would be washed away. • Downstream of the Riverside Park Hotel there are approximately 75 draft nets, fishing for salmon, each have the fishing rights to 1 furlong of river (8 draft nets per mile). Further downstream, there is drift netting for salmon in operation. • Salmon moving upstream tend to keep moving until there is a slowing of pace e.g. at a natural in-river pool or in front of some barrier. If flood relief works effectively maintained a high water flow throughout the town, salmon would not stay in the area for very long.
Island Road	• Residents here are generally elderly and infirm and describe increased levels of stress associated with the whole flooding problem. Most residents reported that they could no longer get home contents insurance which is another worry. • Several people suggested that residents could be relocated.

Table 4.3 Responses to Public Information Day Questionnaire

Reply From	Response
Slaney Search and Rescue	• Access to river via slip-way in Enniscorthy is badly designed and does not work well. • River is non-navigable from Wexford to Enniscorthy during low flows. • Would like to see the parts of the river dredged for both Search and Rescue issues and recreation opportunities, i.e. opportunity to navigate between Enniscorthy and Wexford at all times. Also supplied photos of the 2000 flood event.
Mr P Hall Templeshannon	Has lived in the area for 63 years and confirms that the 1965 flood was the worst in living memory, rising 8 feet within his house compared to 3 feet in both the 1947 and 2000 floods. Would like to see the Slaney at Enniscorthy return to the time when cots were seen sailing and hundreds of people would fish below the bridge.
Mr J Leacy Island Road	Confirms that flooding has taken place in Island Road during 1947, 1965 and 2000. Values both the fishing and riverside walks through Enniscorthy.
Mr V.G. Duigan Slaney Rod Anglers Development Association Ltd	• Primary interest of the Development Association is salmon and trout conservation, and any potential damage to their upstream and downstream migration. • Concerned at any development of this nature and would like to discuss work planned. • Would like to arrange a meeting with between project representatives and Dr Paul Johnston (fishery biologist) to discuss the scheme.

4.5.3 Following the selection of the proposed scheme option for which this report presents the findings of the EIA process, a public consultation day was carried out in September 2008. A limited number of concerns were raised, as summarised in **Table 4.4**. The information presented along with any written consultation responses and list of attendees are presented in **Appendix 4**.

Table 4.4 Public Information Day Responses

Consultee	Response
Slaney Search and Rescue	Concerned over the loss of the access boat slip into the river for their emergency work.
Slaney Rivers Trust	A meeting was held following the Public Information Day, and the following concerns were raised and are to be addressed predominantly in the detailed design phase: • Concern over the effect on migratory fish as well as the other fish species (such as lamprey) that move up and down the river. • Concerned over excessive fishing as a result of holding areas. • Concern that increased flows would affect fish movement and habitat.

4.6 Environmental Impact Assessment

Objectives of Environmental Impact Assessment

4.6.1 The objective of the EIA process is to ensure that:

- The current and future environment within the area of influence of a proposed development is identified and described;
- The activities and physical changes resulting from the construction and operation of the development are identified;
- All activities and physical changes resulting from the scheme and its construction are identified, whether they would result in an impact or a potential impact on the environment and the various environmental aspects;
- The level or significance of all impacts are determined;
- Appropriate measures to avoid (through design changes as well as alterations to the activities) or minimise the impacts are identified; and
- Wherever there are gaps in data or assumptions throughout the EIA process these are described.

4.6.2 **Table 4.5** presents the 'flow' of the processes and procedures carried out during an EIA, and the following sections describe the process in more detail.

The Identification of Impacts

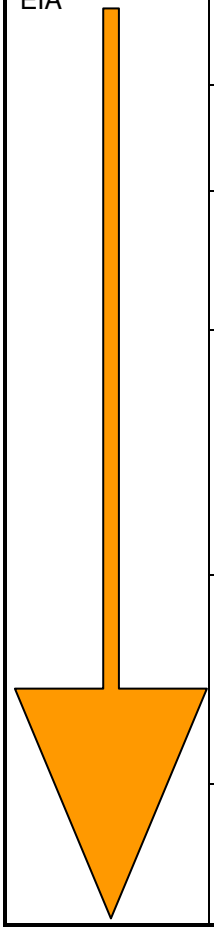
4.6.3 The identification of impacts is dependent on the details available at this stage of the scheme design. Many mitigation measures have or will be designed in to the scheme, and these are identified throughout this EIS. The potential environmental impacts associated with both the construction and operational phases of the proposed scheme were identified through:

- Observations on site;
- A review of the existing and survey data;
- A review of the responses received from interested parties and local residents through consultation undertaken during the preparation of the EIS and also earlier public consultation; and
- A review of impacts associated with other road or similar projects.

4.6.4 The impacts were then examined for their effect in the short-term (up to 2 years), medium-term (2 to 5 years) and long-term (5 to 50 years). Medium-term and long-term impacts are identified as post-construction impacts.

4.6.5 An impact is determined based on the existing baseline environment and the alteration of any physical, chemical, biological or perceived characteristics of that environment. Where impacts occur, methods or actions to reduce or alleviate that impact are introduced. Following the inclusion of mitigation, the impact is reassessed to determine the scale and magnitude of the impact (the 'residual impact'). The residual impact is that which is predicted to occur in the 'real life' scenario. Where mitigation measures are described, their implementation is the responsibility of the developer.

Table 4.5 Summary of EIA Methodology

Stage	Task	Aim/Objective	Work/Output (examples)
Option Development	Determination of Proposed Option	To identify the potentially significant effects of the various proposed options.	Preliminary consultation with key consultees. Targets for specialist studies (e.g. sediment, ecology). Assessment of impact of each option.
EIA 	Consultation	Consult with statutory and non-statutory organisations with an interest in the area.	Local knowledge and information.
	Primary data collection	To identify the baseline/ambient/background/ existing environment.	Biological surveys, archaeological studies, etc.
	Specialist studies	To further investigate those environmental parameters which may be subject to potentially significant effects.	Specialist reports on archaeology, ecology, etc.
	Impact assessment	To evaluate the baseline environment in terms of sensitivity To evaluate and predict the impact (i.e. magnitude) upon the baseline To assess the resultant effects of the above impacts (i.e. determine significance).	Series of significant negative and positive impacts.
	Mitigation measures	To identify appropriate and practicable mitigation measures and enhancement measures.	The provision of solutions to negative impacts. Feedback into the design process, as applicable.
	Environmental Impact Statement (EIS)	Production of the EIS in accordance with Arterial Drainage (Amendment) Act, 1995.	Environmental Impact Statement

Impact Evaluation

4.6.6 Where possible, positive and negative impacts have been evaluated based on their potential scale/magnitude, longevity and significance. Where potential negative impacts were identified, mitigation measures have been defined, and where impacts were identified as irreversible these have been differentiated.

4.6.7 Each impact is identified and described using the following objective criteria, where appropriate:

- Magnitude and Intensity - the area/number of receptors to be affected by the impact within the local and regional context;
- Integrity – the durability of a receptor or its ability to respond to pressure;
- Duration - whether the impact is short-term or permanent; and
- Probability - the likelihood or risk of the impact occurring.

4.6.8 The evaluation of an impact's significance is dependent on the details available at this stage of the scheme design. Where relevant, if detailed information is not currently available, this EIS identifies where detailed design criteria or targets must be met during the detailed design phase.

Impact Characteristics

4.6.9 Following the objective description of the impact, the impact can then be characterised in terms of its nature and magnitude or physical extent. The magnitude or physical extent of impacts has been quantified wherever possible. The nature of predicted impacts has been identified and described, as appropriate, using the following terms:

- Positive or negative;
- Direct or indirect;
- Secondary;
- Short-, medium- or long-term;
- Permanent or temporary;
- Reversible or irreversible; and
- Cumulative.

4.6.10 Where an impact can be quantified, thresholds are applied to determine the significance of an impact, unless otherwise stated. However, these thresholds are widely variable depending on the characteristic of the impact, for example an impact that is irreversible would have a far greater significance than an impact that is reversible, regardless of its magnitude. Any specific thresholds used for an interest would be described in the relevant section of this EIS.

4.6.11 Where an impact cannot be quantified because of the nature or complexity of the impact, a subjective scale is used to determine its significance. Where qualitative descriptions of significance have been used, they have been defined and any uncertainty has been identified. The impact assessment seeks to classify the significance of qualitative effects on a nine point scale (from severe negative to maximum benefit). The magnitude of each

proposed impact is compared with the sensitivity of the area, and the importance of the individual assets. The magnitude of impact is characterised as high, medium or low for both negative and positive impacts. The sensitivity of the features to proposed impacts is characterised on a five-point scale from very high to low. **Table 4.6** presents the impact significance characterisation.

Table 4.6 Derivation of Significance Criteria from Magnitude/Value Comparisons

Magnitude of Effects	Receptor Sensitivity/Value of Feature				
	Very High/ International/ National	High/ Regional/ County	Medium/ District	Low/ Local	Very Low/ Site-Specific
High	Major	Major	Major	Moderate	Minor
Medium	Major	Major or Moderate	Moderate	Minor	Minor
Low	Moderate	Moderate or Minor	Minor	Minor or None	None

4.6.12 In general terms, throughout the following sections it is assumed, unless otherwise stated, that impacts are:

- Short-term during the construction phase (i.e. 18 months);
- Long-term during the operational phase;
- Local rather than regional; and
- Potentially reversible rather than irreversible.

4.6.13 Where potentially significant negative impacts have been identified, mitigating measures have been examined and recommended in order to reduce residual impacts, as far as possible, to environmentally acceptable levels.

4.6.14 Where mitigation measures have been identified and recommended as being both reasonable and successful, the residual environmental impact is identified. This is the impact that would remain following implementation of mitigation. Residual impact can be immediate (i.e. by avoiding the previously identified impact) or may occur after a period of time (i.e. following growth of plants).

4.6.15 The basic definitions of significance (major, moderate and minor) are defined in **Table 4.7**.

Table 4.7 Terminology for Classifying and Defining Environmental Impacts

Impact	Description
Major positive	The activity/effect is expected to lead to a significant benefit, or a series of smaller long-term benefits that would lead to a potential large-scale benefit. In addition, significant cumulative and indirect benefits are likely within and outside the study area.
Moderate positive	The activity/effect is likely to lead to a significant localised improvement or benefit, or to a minor benefit on the larger regional or national scale.
Minor positive	The activity/effect is likely to lead to a moderate benefit, or a significant benefit of local scale. The benefits may be short-term large-scale or long-term and localised in scale. Where short-term benefits occur they are less likely to be reversible.
Negligible positive	The activity/effect is likely to lead to a benefit, however, its scale or magnitude is such that it is difficult to determine in comparison to existing benefits occurring cumulatively or above background improvements.
Neutral / No impact	The activity/effect is not likely to have any positive or negative impacts either the short or long-term. A neutral impact arises when there is a fair degree of certainty that no positive or negative impact is predicted.
Negligible negative	The activity/effect could lead to a negative change or effect, but it is one that is not expected to exceed natural variation.
Minor negative	The activity/effect is likely to lead to a moderate effect on an environmental parameter in the short-term, or a significant impact in a localised area. The impact may be short-term, large-scale, or long-term and localised in scale. The impact may have limited cumulative and indirect impacts within the study area. It is anticipated that mitigation measures can prevent or reduce these impacts.
Moderate negative	The activity/effect is likely to lead to a significant loss or disturbance which is irreversible, or to a minor negative effect on the larger regional or national scale.
Major negative	The activity/effect could threaten specific assets already under threat, and the effects would be hard to reverse or difficult to mitigate, such that irreversible loss could occur or a significant magnitude or area/asset is affected. Indirect impacts may extend outside the study area. Where an activity/effect occurs on or extends to a regionally, nationally or internationally important asset a major negative impact is expected unless otherwise shown.

4.7 The Do Nothing Scenario

4.7.1 The 'do-nothing' scenario describes the baseline as it is expected to evolve in the future, and is the basis for the assessment of impacts of the proposed scheme. Each section describes any potential changes in the baseline environment expected to occur in the future, against which the specific aspects of the proposed scheme are assessed.

4.7.2 In terms of flooding and flood risk within Enniscorthy the standard of flood defence currently provided will decline in the future. Gradual worsening of hydraulic conveyance, however, may well occur due to an increase in self-seeding scrub on the floodplain and/or further encroachment into the flowing river which would have particular impact during flood conditions, both inside and outside of the town. This would occur as there is no current programme of river maintenance.

4.7.3 Present conditions in the southeast of Ireland would be significantly affected if the expected 2050 Climate Change scenario actually occurs. The flooding frequency within Enniscorthy would increase from about 1 in 15 years to 1 in 7 years (i.e. from an expected 3 to 7 events in a 50 year period). The likelihood of severe events would also increase. This implies corresponding growth in both the frequency and magnitude of extreme flow velocities both along the floodplain and within the river. This may well worsen sediment erosion, transport and deposition. Present areas of erosion would see worsening erosion while deposition locations, such as the two sandbars adjacent to the public car park just downstream of the Riverside Park Hotel, will grow. Along with a worsening of upstream flood levels, the deposition patterns could result in obstruction to fish movement, with resulting in declines in fish populations or densities.

4.7.4 Assuming no Climate Change, analysis of the long flood record at Scarrawalsh (upstream of Enniscorthy) estimates that a flood equivalent to the 1965 event has about a 50% chance of occurring in the next 50 years while one equivalent to the 2000 event has a 150% chance. Given the expected climate change the chance increases to 78% and 300% respectively.

4.8 Appropriate Assessment

4.8.1 There are two European Directives relating to nature conservation that are of particular relevance to the proposed development, namely the Council Directive 79/409/EEC on the conservation of wild birds (commonly referred to as the 'Birds Directive') which provides for the protection of wild birds through the designation of Special Protection Areas (SPA), and secondly the Council Directive 92/43/EEC on the conservation of natural habitats and of wild flora and fauna (commonly referred to as the 'Habitats Directive'), for the establishment of Special Areas of Conservation (SAC) for habitats and species listed in Annexes I and II to the Directive. Taken together, the Europe wide network of SPAs and SACs is termed *Natura 2000*.

4.8.2 The Birds Directive and the Habitats Directive were implemented in Irish Law inter alia through the European Union (Natural Habitats) Regulations 1997 (SI No. 94 of 1997), as amended by the European Communities (Natural Habitats) (Amendment) Regulations 1998 (SI No. 233 of 1998) and the European Communities (Natural Habitats) (Amendment) Regulations 2005 (SI No. 378 of 2005). This is of relevance given the location of the proposed development within and in relation to the Slaney Valley cSAC.

4.8.3 Given the nature of this proposal and its location in relation to the Slaney Valley cSAC, an appropriate assessment would be required by the Habitats Directive and has been incorporated within this EIS, as well as clarified and detailed in **Appendix 5**. **Appendix 5** provides all of the information required for an Appropriate Assessment to be undertaken, with supporting detailed information within the relevant referenced sections of this EIS. A summary of the findings of the Appropriate Assessment are presented in **Section 6** and repeated in **Section 7**.

5 HUMAN BEINGS

5.1 Introduction

5.1.1 This section examines the attributes specifically related to human beings, which includes tourism, recreational angling, commercial fishing, the community, land use, and traffic.

5.2 Assessment Methodology

5.2.1 There is no specific assessment methodology relative to the attributes under this heading, consequently, the methodology for the assessment of significance is that described in **Section 4.6**.

5.3 Data Collection

5.3.1 The data for the attributes in this section were obtained from the Wexford County Council Local Plan (1999) and Enniscorthy Town and Environs Development Plan, as well as from site visits.

5.4 Surveys

5.4.1 No surveys were carried out on these attributes to specifically inform the EIA.

5.5 Consultation

5.5.1 Wexford County Council and Enniscorthy Town Council were consulted during the Steering Group Meetings held in relation to the EIA and the proposed flood alleviation scheme. The Councils were also consulted with respect to the examination of flood alleviation options with feedback gained during the Steering Group meetings. Consultation was also undertaken with fisheries and angling groups (including D Byrne of the Eastern Regional Fisheries Board (ERFB)).

5.6 Baseline Environment

Economy

5.6.1 Enniscorthy, is surrounded by countryside, and the local economy is underpinned by agriculture and service industry sector. With regard to Wexford County as a whole, the following conclusions were identified in (Wexford County Council *et al*, 1999):

- Wexford has a relatively old population;
- Participation in the labour force is less than in the rest of the country;
- Unemployment is higher;
- Average family size is greater, and
- The level of educational attainment is lower.

Tourism

5.6.2 The largest single attraction in the town is the Castle Museum, which now has a tourist information centre. The opening of the 1798 Centre, in 1998, has had a significant impact on the number of visitors to the town. The other major tourist attractions include Vinegar Hill, the annual Strawberry Fair, Blackstairs Blues Festival and Marconi connections.

5.6.3 There is a strong tradition of pottery in the Enniscorthy area and there is a trail of the many unique and high quality potteries in the area, which is aimed at the tourist market. In response to the healthy numbers of visitors to the town the Riverside Park Hotel was recently built and overlooks the River Slaney.

Recreational Angling

5.6.4 Historically, the River Slaney was a popular spring salmon fishery and was regarded as one of the best rivers in Ireland for early spring fishing. In recent years the fishery has been closed to salmon fishing and as of 1 January 2009, and in accordance with the Conservation of Salmon and Sea Trout Bye-law (No. C.S. 301, 2008), the fishery is again closed to rod and line fishing for salmon and sea trout over 40cm; although it is still open to angling for sea trout under 40cm. A description of the existing and historical environment for fisheries and angling is described in **paragraph 5.6.12** onwards.

5.6.5 The sea-trout rod and line catch downstream from Enniscorthy Bridge was estimated to be in the region of 1,500, which represents 40-45% of the sea trout caught by rod and line for the entire River Slaney system, which is in the region of 3,500.

5.6.6 Upstream of the old bridge (up to Scarrawalsh Bridge S 983 451) the fishery is privately owned by a Mrs Bolger, but leased by the Solsburgh Anglers Club.

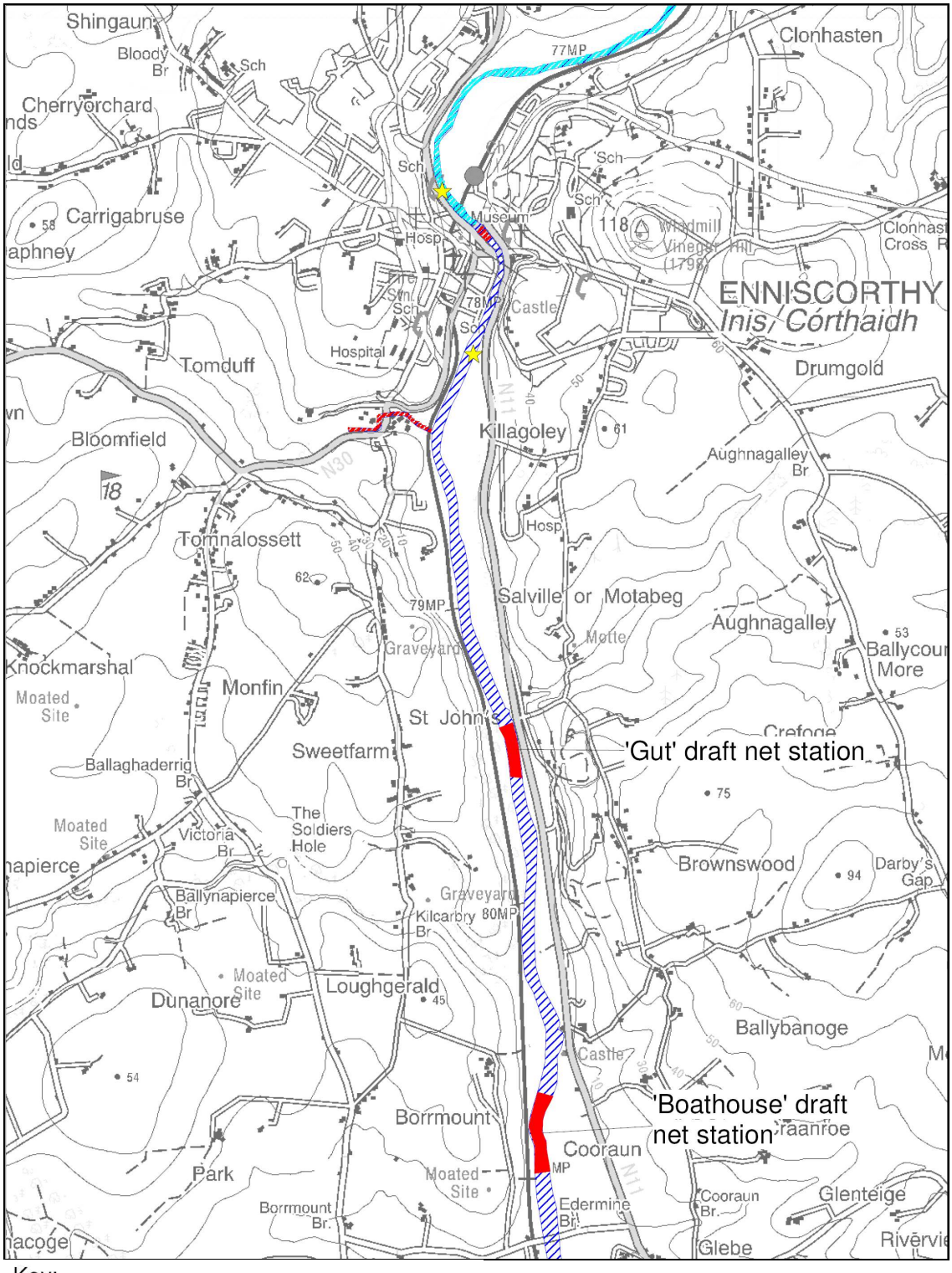
Commercial Fishing

5.6.7 Historically, commercial fyke net fishing for eels occurred in the vicinity of Edermine Bridge, with the main run of adult eels to the sea occurring during late autumn and early winter. Glass eels (juvenile eels) tend to enter the estuarine area of the River Slaney from the sea during the winter and early spring and undergo a number of physiological changes to enable them to survive in freshwater conditions. A second run of these same eels (now referred to as elvers) occurs at the start of the summer in June and July when they migrate into the freshwater stretches of the river. The taking of glass eels and elvers is strictly prohibited in Ireland.

5.6.8 Historically, the River Slaney Estuary had an important twaite shad fishery, with large numbers caught commercially on the lower estuary. Recent surveys confirm that both twaite shad and allis shad populations exist in the estuary. Both shad species are listed in Annex II of the Habitats Directive. Further monitoring by the EFRB is being undertaken relating to shad populations in the River Slaney. Both species of Shad tend to spawn in freshwater just above the tidal / freshwater boundary from May to June.

5.6.9 Smelt have also been recorded from commercial net catches in the Wexford Harbour / River Slaney Estuary area. Potentially this species could be spawning in the River Slaney around Enniscorthy (ERFB, D Byrne, *pers comm.*, 2005). Smelt enter estuaries in spring and spawn in fresh or brackish water.

Figure 5.1 Historic Commercial and Recreational Fishing Areas



Community

5.6.10 Enniscorthy covers an area of just 147 acres. It has a population of 3,128 people (1996 census of population); although the town and its immediate environs have a population of 9,193 people and services a rural electoral district of 26,145 people.

Land Use

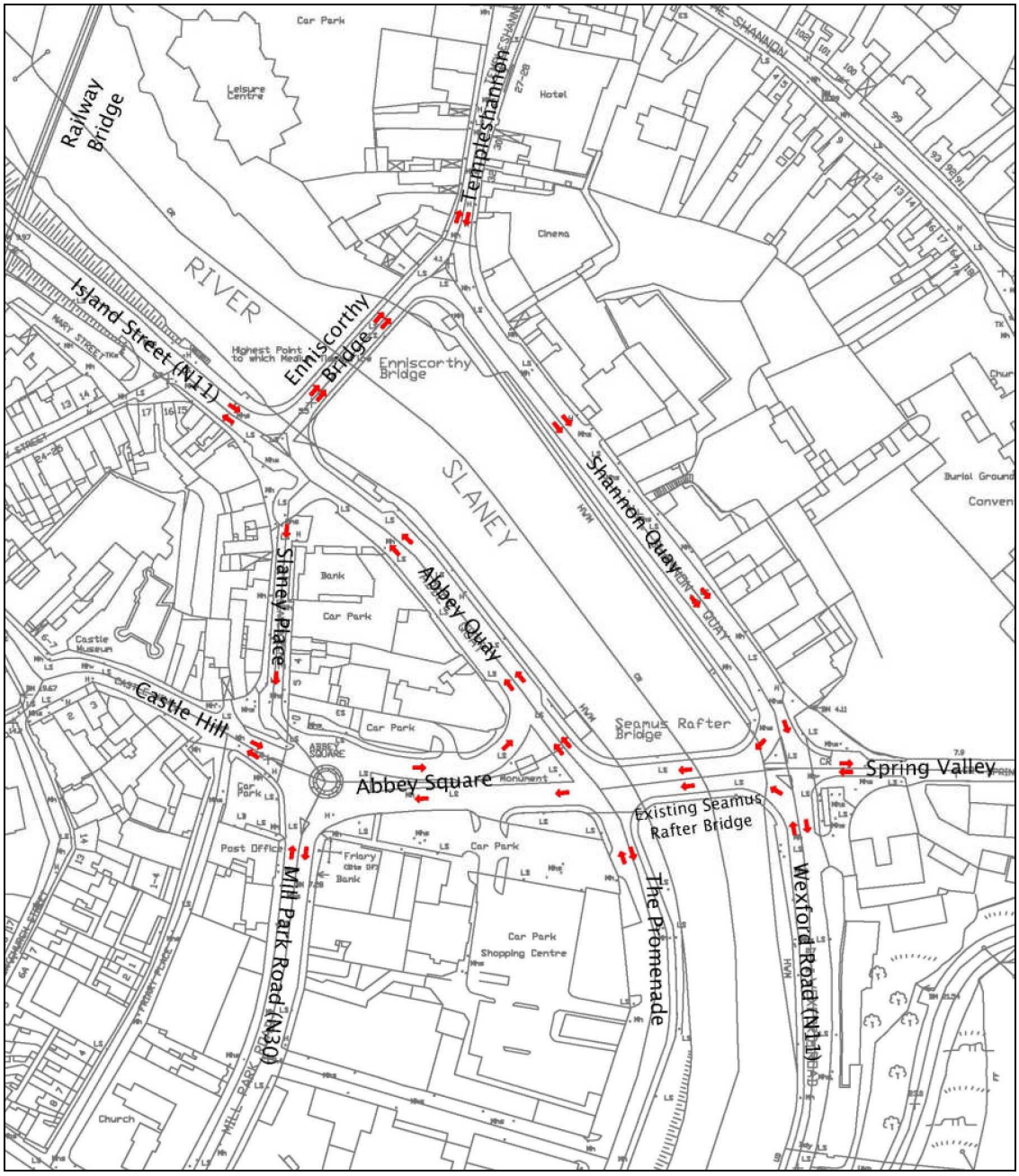
5.6.11 The area surrounding Enniscorthy is predominantly agricultural land interspersed with residential and agricultural properties. Within the area there are bands of unimproved wetland habitat that follow the river courses and also a large woodland area downstream of Enniscorthy on the west bank of the River Slaney.

Traffic

5.6.12 There are a number of roads providing access and egress into and out of Enniscorthy. The most significant road is the N11 which bisects Enniscorthy and consists of high traffic flows. During flood events the N11 is prone to flooding causing major disruption. **Figure 5.2** presents the current national and local road network within Enniscorthy. The current road network within and around Seamus Rafter Bridge consists of the following:

- Shannon Quay (N11) northern approach road operates as a two-lane one-way operational road, with traffic travelling from north to south. At the junction of Shannon Quay (N11) and Seamus Rafter Bridge two raised traffic islands are in place. The purpose of the traffic islands is to split traffic into three directions:
  - Right onto Seamus Rafter Bridge;
  - Straight ahead onto the Wexford Road (N11); or
  - Left onto Spring Valley Road.
- The Spring Valley Road operates as a two-way road with one-way lane in each direction. At its junction with Shannon Quay (N11) and the Wexford Road (N11) two traffic islands are in place. The traffic islands split traffic into three directions:
  - Straight ahead for west-bound traffic onto Seamus Rafter Bridge;
  - Left turn for south-bound traffic on Wexford Road; and
  - Left turn off Shannon Quay (N11) onto Spring Valley Road east-bound.
- The Wexford Road (N11) southern approach road to the existing Seamus Rafter Bridge operates as a two-lane two-way operational road. At the junction of Wexford Road (N11) with Shannon Quay (N11) and Seamus Rafter Bridge a raised traffic island is in place. The purpose of the island is to direct traffic approaching the town centre from the south onto Seamus Rafter Bridge. This is the only permitted movement for traffic approaching the town centre from the south on Wexford Road (N11).
- Seamus Rafter Bridge is a one-way road with traffic travelling from east to west. The road is split into three lanes:
  - Right turning onto Abbey Quay (N11) for north-bound traffic;
  - Straight ahead into Abbey Square for east-bound traffic; and
  - Left turn onto Promenade Road.
- On Abbey Quay (N11) the road operates as a two-lane one-way operational section of roadway with traffic travelling from south to north.

Figure 5.2 Current Road Network and Routes within Enniscorthy



5.6.13 The morning traffic peak hour occurs between 08:30 and 09:30 (DBFL, 2008). Based on the 2007 base flows presented in the DBFL (2008) report, the following can be described about the morning and evening peak hour traffic flows, as shown on **Figures 5.3** and **5.4** from the DBFL report.

5.6.14 During the morning peak hour, traffic volumes increase with the Island Street / Abbey Quay / Enniscorthy Bridge junction operating above capacity. Queuing from the north approach to this junction has been noted to extend back as far as the Blackstoops Roundabout which is located approximately 1.5 km north of Enniscorthy. Turning count figures at the Island Street / Abbey Quay / Enniscorthy Bridge junction indicate that around 700 vehicles turn left from the N11 onto Enniscorthy Bridge during the morning peak hour (Mott McDonald, 2008). An additional 500 vehicles turn right from the N11 north-bound,

therefore a total of around 1200 vehicles travel across the Enniscorthy Bridge during the morning peak hour (Mott McDonald, 2008). Queues also occur on the Templeshannon Road (R744) from its junction with Enniscorthy Bridge. Of the 1200 vehicles which cross the Enniscorthy Bridge in the morning peak hour, around 400 turn left onto Templeshannon Road (R744) and 800 turn right onto Shannon Quay (N11). In addition, around 600 vehicles turn left onto Shannon Quay (N11) from the Templeshannon Road (R744). The total number of vehicles travelling south on Shannon Quay (N11) during the morning peak is therefore around 1400 (Mott McDonald, 2008).

5.6.15 At the junction of Shannon Quay (N11), Spring Valley, the Wexford Road (N11), and Seamus Rafter Bridge queuing does not appear to be as significant as it is at the Island Street / Abbey Quay / Enniscorthy Bridge junction. However, relatively short queuing occurs on Spring Valley Road during the morning peak (Mott McDonald, 2008). At the Spring Valley Road junction, of the 1400 vehicles travelling south along Shannon Quay, around 650 turn right onto Seamus Rafter Bridge, with another 650 continuing south onto the Wexford Road (N11), whilst the remaining 100 vehicles turn left onto Spring Valley Road. The 650 vehicles turning right onto Seamus Rafter Bridge is joined by around 250 vehicles continuing west from Spring Valley Road, and around 600 vehicles turning left from the Wexford Road (N11). The total number of vehicles travelling across Seamus Rafter Bridge during the morning peak hour is around 1500 (Mott McDonald, 2008).

5.6.16 The priority junction between Abbey Quay (N11) and the Abbey Square (N30) is also over capacity at times during the morning peak, which in turn leads to some tailbacks extending to the junction of Millpark Road (N30) and Castle Hill (R702); as a result queuing occurs on both of these roads (Mott McDonald, 2008). The volume of traffic travelling north on Abbey Quay during the morning peak hour is around 1275 vehicles, comprising around 650 vehicles turning right Seamus Rafter Bridge, around 75 vehicles travelling straight ahead from the Promenade Road, and the remaining 550 vehicles turning left from Abbey Square (Mott McDonald, 2008).

5.6.17 The evening peak period occurs between 15:30pm and 17:30pm (BDFL, 2008). In this period, congestion mainly occurs on Island Street (N11), with queuing at the junction of the N30 and the N11 at Abbey Quay, which leads to tailbacks on Milltown Park (N30) and above all on Castle Hill (R702). Counts indicate that the volume of traffic during this period is similar or slightly less than that in the morning peak hour (Mott McDonald, 2008); however, there is a greater movement of traffic onto Templeshannon (R744) than there is in the morning peak which could be a result of the number of residential areas that are accessed from Templeshannon (R744) (Mott McDonald, 2008).

5.6.18 Of the other traffic in the area, the following can be said:

- Bus services in Enniscorthy are provided by Bus Éireann and private bus operators. The Bus Éireann stop is on Shannon Quay, and it can act as a source of congestion as the bus stop is regularly blocked by parked cars or service vehicles (Mott McDonald, 2008);
- No dedicated cycle facilities are in the immediate vicinity of the Seamus Rafter Bridge;
- Existing pedestrian facilities consist of footpaths that run along the street-sides; these range in widths from 1.5m to 2.0m, however, pedestrian crossing points in the town centre are poor (Mott McDonald, 2008);
- No HGV bans or specified routes are in operation (Mott McDonald, 2008);
- No dedicated taxi ranks are present in the immediate vicinity of Seamus Rafter Bridge or Abbey Quay.

Figure 5.3 Morning Peak Hour Traffic Flows from DBFL (2008) Report

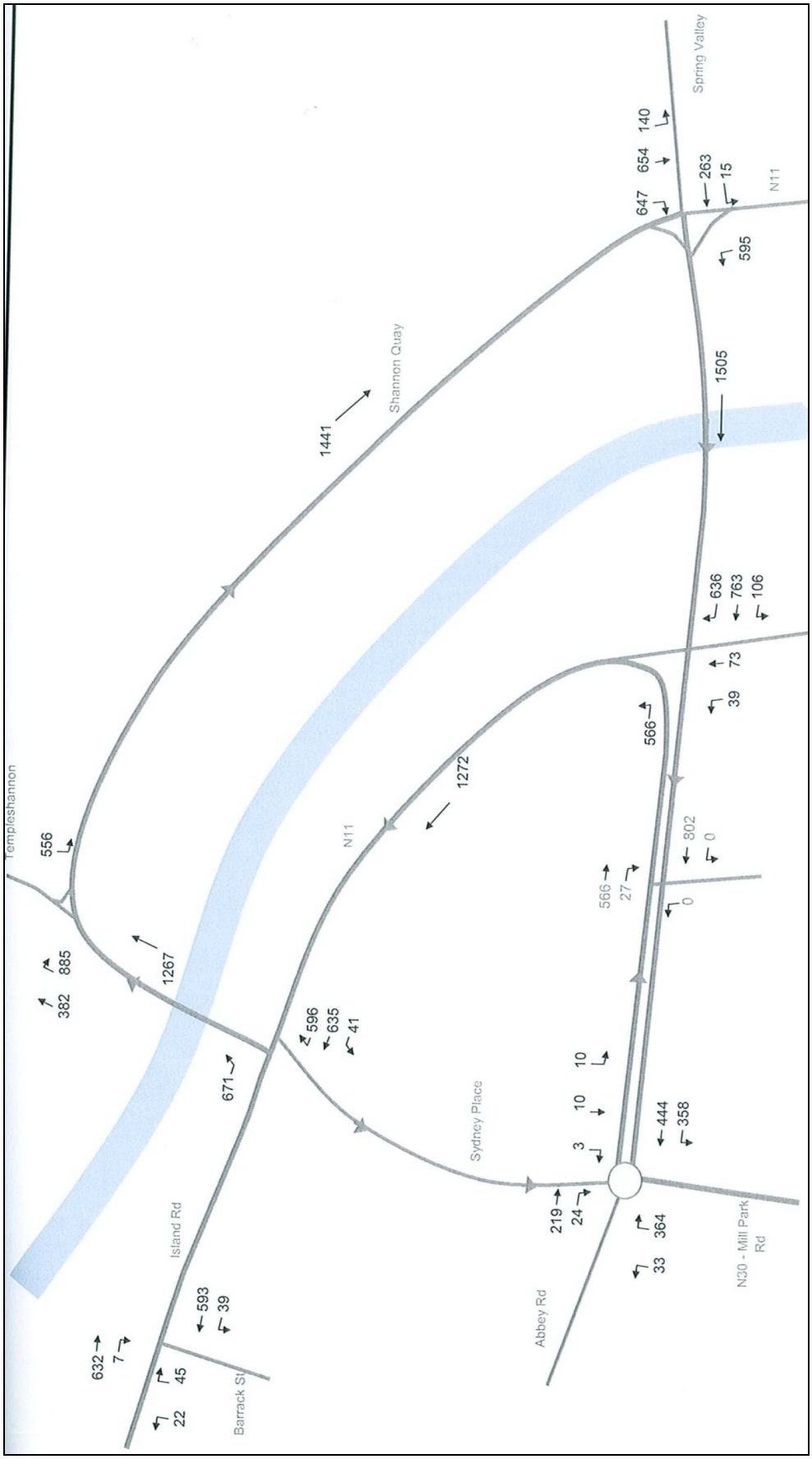
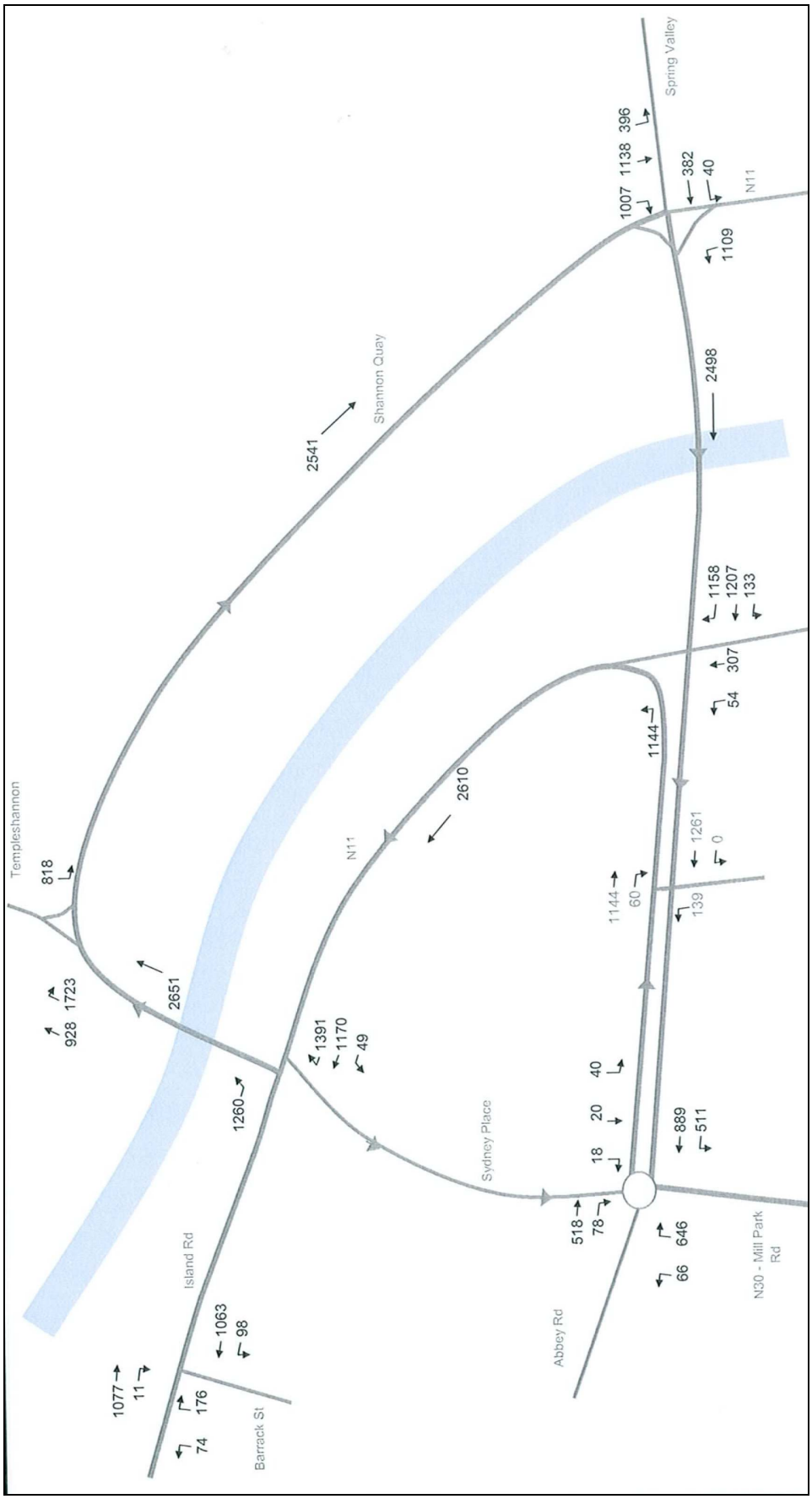


Figure 5.4 Evening Peak Hour Traffic Flows from DBFL (2008) Report



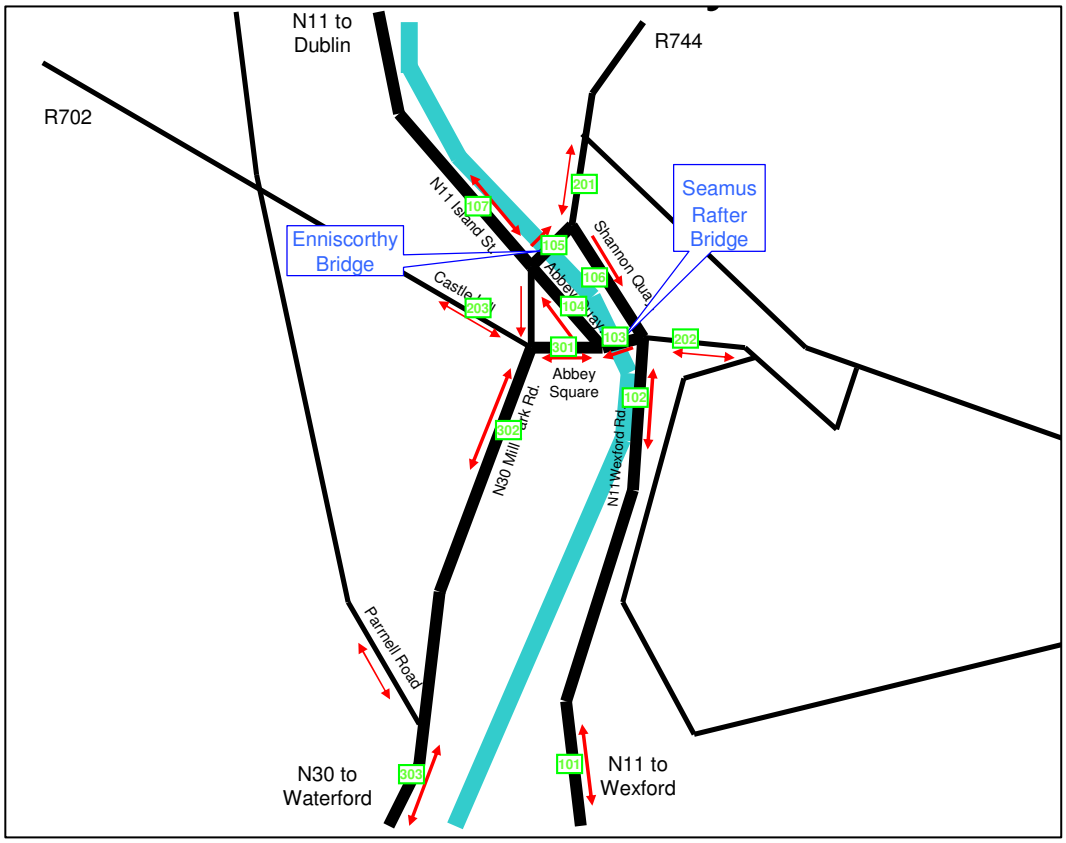
5.6.19 The daily traffic flows or Annual Average Daily Traffic (AADT) flows for the road network are summarised in **Table 5.1**, with the road references presented in **Figure 5.5**.

Table 5.1 Annual Average Daily Traffic in Enniscorthy for 2007

Road Ref.	Road Segment	Number HCV*	Number non-HCV	AADT	%HCV
101	Wexford Road south(N11)	1,414	11,271	**12,685**	12.5%
102	Wexford Road north(N11)	1,414	11,271	**12,685**	12.5%
103	Seamus Rafter Bridge	1,434	17,965	**19,399**	8.0%
104	Abbey Quay	1,302	16,305	**17,607**	8.0%
105	Enniscorthy Bridge	1,398	15,289	**16,687**	9.1%
106	Shannon Quay	1,148	13,403	**14,551**	8.6%
107	Island Rd (N11 north)	1,486	15,264	**16,751**	9.7%
201	Templeshannon (R744)	533	10,218	**10,751**	5.2%
202	Spring Valley	245	4,686	**4,931**	5.2%
203	Castle Hill (R702)	450	8,619	**9,068**	5.2%
301	Abbey Square	1,294	15,117	**16,411**	8.6%
302	Mill Park Rd (N30)	1,170	8,714	**9,884**	13.4%
303	N30	454	5,097	**5,551**	8.9%

* HCV = Heavy Commercial Vehicle

Figure 5.5 Current Road Network within Enniscorthy



Planning and Development Control

5.6.20 **Tables 5.2** and **5.3** identify the key policies within the Wexford Local Development Plan and the Enniscorthy and Environs Development Plan respectively, which are relevant to a proposed flood alleviation scheme and the potential impacts that could result.

Table 5.2 Relevant Policies/Objectives from the Wexford County Development Plan

Policy/Objective	Description	Potential Constraint
Tourism (Section 6.3)	In support of the development of sustainable tourism, the County Council will: • protect inland waterways as resources for water based activities including angling and cruising;	Loss of fishing access, reduction in fish numbers due to an alteration in the flow regime.
Protecting water resources (Section 7.3)	In support of this commitment the County Council will: • ensure compliance with the *Protection of Groundwater Regulations 1999*; • continue to implement, monitor and refine the Aquifer Protection Policy and prohibit development which would contravene that policy; and • have regard to the Precautionary and Polluter Pays Principles.	Options such as dredging can potentially lead to contaminants entering the groundwater.
Recreation, Community Facilities and Services (Section 7.12)	The County Council will: • encourage the use of the County's high quality natural and physical environment, coastal and rural landscapes and amenities for active and passive recreation while avoiding overuse and adverse environmental impact to these resources; • preserve and protect existing rights-of-way and access routes and investigate the creation of new rights-of-way where appropriate in consultation with landowners and statutory bodies; and • promote the recreational use of the county's rivers and coastal zone while protecting these areas from development which would detract from their amenity value and recreational capacity.	Loss of riverside routes / walks.
Protecting the Archaeological Heritage (Section 8.2)	In seeking to protect the County's archaeological heritage, the County Council will: • seek to preserve and maintain known existing archaeological monuments as set out in *'The Record of Monuments and Places'* and to safeguard the integrity of the setting of archaeological sites; • exercise a presumption in favour of avoidance of development impacts on the archaeological heritage and seek the preservation in situ of archaeological sites and monuments as the preferred option; and • protect the special attributes of the historic landscape including battlefields.	Works in several areas within the Constraints Study Area could potentially affect Recorded Monuments or the setting of Recorded Monuments.

Policy/Objective	Description	Potential Constraint
Nature Conservation (Section 8.3)	The County Council will: • prohibit development which would damage or threaten the integrity of sites of international or national importance, designated for their habitat/wildlife or geological / geomorphological importance including the proposed Natural Heritage Areas, candidate Special Areas of Conservation, Special Protection Areas and Statutory Nature Reserves unless the County Council is satisfied that: • there is no alternative solution. there are strong reasons of over-riding public interest for the development.	The Constraints Study Area includes the Slaney Valley cSAC and is within 1km of both Ballynbarney NHA and Greenville recommended NHA.
Conserving the Built Environment (Section 8.4)	The County Council will: • seek the preservation and protection of the structures contained in the *Record of Protected Structures*; • safeguard the character and setting of protected structures through control of the design of new development in its vicinity, by the control of the change of use of adjacent land to ensure that there is no adverse material impact and by the preservation of trees and other site features as and where appropriate;	Works in several areas within the Constraints Study Area could potentially affect Protected Structures or the setting of Protected Structures.
Areas Designated as Vulnerable (Section 8.5.2)	Within or adjacent to these areas: • any development which would adversely affect the natural beauty of their landscapes will be strongly resisted.	Both riverbanks and the skylines of upland areas are designated as 'vulnerable' within the Wexford County Development Plan.
Areas Designated as Sensitive (Section 8.5.3)	Within or adjacent to sensitive areas: • any development which would adversely affect the natural beauty of their landscapes will be strongly resisted.	Natural grassland, transitional scrub, broad-leaved forest and mixed forest are designated as 'sensitive' within the Wexford County Development Plan.

Table 5.3 Relevant Policies from the Enniscorthy Town and Environs Development Plan

Policy	Description	Potential Constraint
2.7.1 (II) Preservation and conservation of buildings, structures and sites	Preserve and protect buildings, structures and sites of architectural, historic, artistic or archaeological interest and which contribute to the character and heritage of the County.	Buildings and structures of archaeological interest are highlighted in **Section 14**.
2.8.2 (I & III) Public rights of way	(I) Protect and preserve those existing rights of way, which contribute to general amenity and are not a source of anti-social behaviour. (II) Promote the development of river-side walking routes and foster the enjoyment of the natural amenities of the area including the River Slaney and Vinegar Hill.	Loss of riverside access / walks.
2.8.3 (I) Views and prospects	Protect views and prospects of special amenity value or interest.	Flood relief structures may impact upon the local setting.
2.11.3 (I, II and III) Tourism product	(I) Give favourable consideration to the development of leisure or recreational facilities that are activity orientated and involve the appropriate use of the River Slaney and where such proposals accord with the proper planning and development. (II) Encourage the physical improvement of the river through installation of benches/seating, landscaping schemes and environmental works. (III) Seek to develop environmental (green/eco) tourism in association with An Dúchas and other groups or partners.	
2.12.3 (I, II, III, IV and V) Surface water quality, drainage systems and flood control	(I) Protect existing groundwater aquifers and surface waters from pollution. (II) Protect the water quality of the River Slaney and continue to implement the Water Quality Management Plan for the River Slaney, and to ensure that the water quality of the river is maintained at a satisfactory level in accordance with EU Directive Number 78/659 that lists the river as a salmonid river. (III) Prevent the alteration of natural drainage systems and in the case of development works require the provision of acceptable mitigation measures in order to minimise risk of flooding and negative impacts on water quality. (IV) Promote storm water retention facilities for new developments and existing catchment areas.	Options such as dredging can potentially lead to a change in water quality and the possibility of contaminants entering the groundwater.

Policy	Description	Potential Constraint
	(V) Preserve and protect the water quality of the natural wetlands and flood plains of the River Slaney where these help to regulate stream flow, recharge groundwater and screen pollutants.	
2.12.7 (l) Air quality	Protect ambient air quality in the town.	

5.7 Do Nothing Scenario

Residents and the Community

5.7.1 Severe flooding affects a large number of residential properties and causes displacement of residents and short term severance of communities (also due to flooding of roads). Based on the area flooded in 1965, 180 (present day) properties within Enniscorthy would be damaged by the flood event. The 2000 event was lesser in extent and affected around 109 properties. Therefore, at least 10% of the 1000 residential and commercial properties within Enniscorthy are likely to be damaged several times in the next 50 years (see **paragraph 4.1.2**).

Employment

5.7.2 Flooding affects commercial properties and could potentially lead to subsequent collapse of a number of commercial enterprises, thereby leading to loss of jobs. Three to seven significant flooding events (depending on Climate Change) are likely within the next 50 years. These could affect local business leading to a limited reduction in local employment.

Local Economy

5.7.3 As well as the potential disruption to commercial properties and the subsequent economic losses, flooding would also cause property damage that would result in economic losses either to residents or to insurance companies. Insurance levels within Enniscorthy have purportedly risen due to the flooding in 2000, and some residents may not be able to afford the increased rates. Furthermore, the closure of roads and railway during a flood event incurs costs for private and commercial transport, due to delays and diversions.

5.7.4 The OPW calculated the likely costs of flooding (discounted at 5%) in Enniscorthy by events up to a return-period of 100-year, over the next 50 years; and these are estimated at €43M, excluding traffic disruption effects.

5.7.5 While the duration of flooding is short, economic costs are incurred for some duration afterwards, particularly where residential or commercial properties require restoration, cleaning, etc., resulting in the cessation of commercial activities or residence in place.

5.7.6 The likelihood of these impacts and subsequent costs occurring are high.

Health and Safety

5.7.7 When foul sewers become flooded their material enters residential and commercial properties thereby impacting health by increasing the risk of disease. Overland flooding affects public roads and footways thereby impacting safety as this could potentially result in people being swept into the river and possibly lead to the loss of life.

5.7.8 The magnitude of both effects is considered low. While around 110 properties or more are likely to be affected, a cleanup should lower the potential health threat to a small number of people and, likewise, the safety risk would only impact a small number of individuals.

5.7.9 The duration of the threats are short-term and are typically in the order of a few days.

5.7.10 The likelihood of the risk is low, as there have as yet been no recorded accidents or illnesses attributed to the last four flooding events.

Angling

5.7.11 The River Slaney is currently closed to angling for salmon and sea trout over 40cm in 2009 with closures reviewed on a year by year basis.

5.7.12 Should the fishery re-open in the foreseeable future, flood events could potentially prevent angling within Enniscorthy and along the River Slaney due to inability to access the riverside or flooding of the angling areas or due to safety issues.

5.7.13 Quite extensive lengths of the riverside would be affected and consequently, in terms of the study area quite large numbers of anglers could be affected.

5.7.14 For each particular event, the effect would generally extend for the duration of the overland flooding (i.e. longer than the duration of town flooding that might accompany the event). There is also the possibility however, that local anglers might not be in a position to resume fishing for quite some time due to flooding of their own properties.

5.7.15 A significant number of these floodplain events will occur in the next 50 years and this could double under the present expectation of Climate Change. The possibility exists, however, that many of these could occur during times in the year when angling does not take place.

Recreational and Other Navigation

5.7.16 High river levels and flows during a flood event preclude recreational navigation activities, due to the potential dangers that may arise.

5.7.17 Recreational navigation on the River Slaney, both within and outside Enniscorthy, is limited in size and numbers of participants and consequently, few people are affected.

5.7.18 The disturbance would occur for the duration of high river levels and flows, i.e. several days.

5.7.19 There will be a significant number of floodplain events (more than the expected three town flooding events) within the next 50 years and expected Climate Change could more than double this number.

Emergency Access

5.7.20 Historic flood events within Enniscorthy have closed roads and access to the riverside; such closures prevent access by emergency services. The fire station, hospital and main police station are all on the right bank (west side) of the river so closures impact their ability to respond to 'call outs' on the east side of the river. Severe weather conditions, coupled with flooding, generally mean an increased need for these services so they are restricted during clear peak response times. This may result in loss-of-life that might otherwise be avoided. Without including a monetary cost to account for possible loss-of-

life, the cost to emergency services due to the impact of flooding has been estimated at €3.5M. Under the expected 2050 Climate Change Scenario, this cost would rise to about €9M.

5.7.21 The few affected roads do provide routes to locations both within and outside Enniscorthy (particularly east of the river) that may not be accessible by any other route.

5.7.22 For each particular event, the prevention of access would generally extend for up to two days or perhaps more (i.e. for the duration of the flooding within the town).

5.7.23 Three significant flooding events are likely within the next 50 years and this could increase to seven under the present expectation of Climate Change.

Amenity

5.7.24 Access to the riverside is inhibited during flooding and floodwater is a safety issue that prevents people from enjoying the peaceful and characteristic amenity of the riverside areas.

5.7.25 Extensive stretches of the riverside in the study area are affected.

5.7.26 For each particular event, prevention of access extends for the duration of overland flooding (i.e. longer than the duration of town flooding that might accompany the event).

5.7.27 There will be a significant number of floodplain events (more than the expected three town flooding events) within the next 50 years and expected Climate Change would double this.

Traffic

5.7.28 Deep flooding of a number of roads within Enniscorthy results in the prevention of access by vehicular and pedestrian traffic. This disrupts local traffic (vehicles travelling to, from, and within Enniscorthy) as well as through traffic. The major roads affected are the N11 (comprising the Wexford Road, Shannon Quay, Abbey Quay and Island Street), the N30 (the New Ross / Waterford Road) and the R744. The N11 is a European designated road as it forms part of the France, Ireland to Scotland route and its closure, therefore, certainly represents a significant impact of national importance. Disruption to these major roads results in large numbers of vehicles being obstructed or requiring long distance diversion.

5.7.29 Access onto the R702 is impeded from these major roads and small roads (such as Temple Shannon, Irish Street, Mary's Street, Slaney Place and Promenade Road) are also affected. Local traffic is particularly affected as access to properties is obstructed.

5.7.30 For each particular event, the prevention of access would generally extend for up to two days or perhaps more (i.e. for the duration of flooding within the town).

5.7.31 Three to seven significant flooding events (depending on Climate Change) are likely within the next 50 years. The monitory cost of 'Traffic Disruption' has not been calculated to date (this significant study may be carried out at the Detailed Design Phase of this flood relief project); it is considered likely to be in the order of several million euro.

5.7.32 The predicted Annual Average Daily Traffic (AADT) flows for 2012 and 2027 are presented in **Tables 5.4** and **5.5**, and are derived from the traffic growth rates identified in the NRA's "*Future Traffic Forecasts 2002-2040*" (NRA, 2004). **Table 5.6** presents the % growth rates that have been used.

Table 5.4 Annual Average Daily Traffic in Enniscorthy for 2012

Road Ref.	Road Segment	Number HCV	Number non-HCV	AADT	%HCV
101	Wexford Road south(N11)	1,649	13,012	**14,662**	12.7%
102	Wexford Road north(N11)	1,649	13,012	**14,662**	12.7%
103	Seamus Rafter Bridge	1,673	20,740	**22,413**	8.1%
104	Abbey Quay	1,519	18,824	**20,342**	8.1%
105	Enniscorthy Bridge	1,631	17,650	**19,282**	9.2%
106	Shannon Quay	1,339	15,474	**16,812**	8.7%
107	Island Rd (N11 north)	1,734	17,622	**19,356**	9.8%
201	Templeshannon (R744)	572	10,954	**11,526**	5.2%
202	Spring Valley	262	5,024	**5,286**	5.2%
203	Castle Hill (R702)	483	9,240	**9,722**	5.2%
301	Abbey Square	1,510	17,452	**18,962**	8.7%
302	Mill Park Rd (N30)	1,365	10,060	**11,425**	13.6%
303	N30	530	5,884	**6,414**	9.0%

Table 5.5 Annual Average Daily Traffic in Enniscorthy for 2027

Road Ref.	Road Segment	Number HCV	Number non-HCV	AADT	%HCV
101	Wexford Road south(N11)	2,179	16,403	**18,582**	13.3%
102	Wexford Road north(N11)	2,179	16,403	**18,582**	13.3%
103	Seamus Rafter Bridge	2,211	26,144	**28,355**	8.5%
104	Abbey Quay	2,007	23,728	**25,735**	8.5%
105	Enniscorthy Bridge	2,156	22,249	**24,405**	9.7%
106	Shannon Quay	1,769	19,506	**21,275**	9.1%
107	Island Rd (N11 north)	2,291	22,214	**24,505**	10.3%
201	Templeshannon (R744)	665	12,519	**13,184**	5.3%
202	Spring Valley	305	5,742	**6,047**	5.3%
203	Castle Hill (R702)	561	10,560	**11,121**	5.3%
301	Abbey Square	1,995	21,999	**23,995**	9.1%
302	Mill Park Rd (N30)	1,804	12,682	**14,485**	14.2%
303	N30	700	7,418	**8,118**	9.4%

Table 5.6 Annual Average Daily Traffic Growth Rates for 2012 and 2027

Road Type	% Growth Rate			
	2007-2012		2012-2027	
	HCV	Non-HCV	HCV	Non-HCV
National Primary	16.7%	15.4%	32.1%	26.1%
Non-national	7.3%	7.2%	16.2%	14.3%

5.7.33 In the future, Wexford County Council intends to build a bypass around Enniscorthy for traffic heading to or from Dublin to other destinations to the south of Enniscorthy. Modelling data indicates that the bypass would result in a reduction in 2011 traffic volumes in the town centre of approximately 40% on Seamus Rafter Bridge, and 90% on the N11 Dublin Road, to the north of the town.

5.7.34 The significant reduction of traffic entering Enniscorthy from the N11 Dublin Road anticipated as a result of the bypass would have a major effect on congestion levels at the Island Street / Abbey Quay / Enniscorthy Bridge junction and also at the Enniscorthy Bridge / Templeshannon junction, significantly reducing queues.

5.7.35 However, with the bypass, there would be no predicted decrease in traffic volumes on the N30 southern approach to the town centre.

5.8 Potential Environmental Impacts during Construction

IMPACT: Disruption to Angling Access during Construction

5.8.1 If the current salmon and sea trout fishing closure on the River Slaney were to remain in place for the years after 2009, then there would be no disruption to salmon angling during construction of the proposed flood alleviation scheme, and **no impact** would arise.

IMPACT: Disruption to Recreational or Other Navigation during Construction

5.8.2 During river works, any barge or other water-based or water-working construction equipment could cause a physical obstruction within the river. In addition, a closed off area around construction equipment and works may be necessary for health and safety purposes. This too could cause an obstruction to navigation within the river. These types of obstructions within the river could affect the movement and passage of recreational vessels.

5.8.3 Both within and outside of Enniscorthy, recreational navigation on the River Slaney is limited in size and number of participants; consequently, few people would be affected.

5.8.4 The disturbance to this resource would occur for a relatively long duration (e.g. around six months, albeit for small localised areas of the river. Works would take place during the daytime, during a period when river levels and flows are low and conditions calm (e.g. over summer), and machinery and barges moored up at night.

5.8.5 Due to the health and safety requirements under legislation vessels and machinery working in rivers must undertake a number of actions to prevent the risk of collision with other vessels, as well as reduce obstruction to the waterway as much as possible. Consequently, the likelihood of any significant or noticeable obstruction occurring is very low.

5.8.6 Using the criteria in **Table 4.6**, the magnitude of the effect is low, and the sensitivity and value of the activity in the study area is very low. Consequently, **no impact** is anticipated.

IMPACT: Loss of Amenity Access during Construction

5.8.7 During construction of the permanent floodwalls and embankments, access to existing footpaths alongside the river would be diverted. The footpaths that would be affected are:

- The footpath along Promenade Road;
- The footpath along the N11 Wexford Road on the left bank of the river downstream of Seamus Rafter Bridge;
- The footpath along Abbey Quay from Seamus Rafter Bridge to Enniscorthy Bridge;
- The footpath alongside Shannon Quay from Seamus Rafter Bridge to Enniscorthy Bridge; and
- The right bank upstream of the Railway Bridge.

5.8.8 The diversions would be temporary (i.e. for the duration of the construction work along each stretch), though at present the Detailed Design has not been undertaken; however, all footpaths would be diverted to run close by the existing stretch of path, with the exception of the right bank upstream of the Railway Bridge. Using the derivation criteria in **Table 4.6**, the magnitude of the effect is medium because large lengths of the riverside would be affected, though it is likely that short lengths would be disturbed at any one time, and the value of the access is considered to be medium/district in level, due to the influx of tourists to the area. Consequently, a short-term **moderate negative impact** is predicted.

IMPACT: Disruption to Traffic during Construction

5.8.9 The scheme will entail road and ground raising, river widening, and construction of walls and movement of services within several areas of Enniscorthy, during the construction phase of the scheme, as well as connecting the new bridge to the road network. These works have the potential to disrupt or obstruct traffic movements. The works that would result in potential disturbance to traffic will be:

- Road raising along Promenade Road including movement of sewers as a result of river widening;
- Road raising, wall construction, and some river widening along Abbey Quay;
- Wall construction and raising the footpath along Shannon Quay;
- Connection of the new bridge to the N11 Wexford Road and N30 Waterford Road.

5.8.10 For all the above sections of work along the road network, there is sufficient lane width along these to enable one lane of flow past the works area at a time, and to then move onto the unaffected part. Traffic signalling may be required for the connection of the new bridge to the road network, and also for the raising of the N11 in order to enable oncoming traffic to pass in narrowed or closed off lanes. Alternatively, minor diversion of the N30 and N11 could be undertaken for the connections with the new bridge, by using land to the east of the N30 and to the west of the N11 to accommodate these minor diversions. All the diversions will be short-term in nature, but due to the high levels of traffic flow the sensitivity of the receptor is high, whilst the lengths of road disturbance would be short (no more than 200m at a time). Consequently, a short-term **moderate negative impact** is anticipated during the construction phase.

5.9 Potential Environmental Impacts during Operation

IMPACT: Protection of Residential and Commercial Properties from Flooding

5.9.1 The implementation of this scheme would have a **major positive impact** on residential and commercial properties in Enniscorthy by preventing flooding and the associated protection of properties from damage that would otherwise occur in the do-nothing scenario.

IMPACT: Local Employment

5.9.2 The effect of flooding on local employment that would otherwise occur if the scheme was not implemented would be prevented. Consequently, a **minor positive impact** would arise.

IMPACT: Local Economic Effects

5.9.3 As identified in **paragraph 5.7.4**, the OPW calculated the likely costs of flooding in Enniscorthy by events up to a return-period of 100-year, over the next 50 years to be €43M, excluding traffic disruption effects. The proposed scheme would prevent flooding and the costs associated with it. Consequently, a **major positive impact** is anticipated in terms of offsetting the local economic costs of flood event.

IMPACT: Health and Safety

5.9.4 The effect of flooding on health and safety that would otherwise occur if the scheme was not implemented would be prevented. Also, the likelihood of loss of life would be reduced. Consequently, a **major positive impact** is anticipated.

IMPACT: Disruption to Angling Access during Operation

5.9.5 Depending upon the final design and placement of the permanent floodwalls throughout Enniscorthy, including the stretch immediately downstream of Enniscorthy Bridge, these structures could potentially restrict access for fishermen to the river should it re-open to salmon and sea trout angling. Using the criteria in **Table 4.6**, the receptor is national in scale and the magnitude is considered to be high. Therefore, up to a localised **moderate negative impact** could arise.

5.9.6 Provided design measures are incorporated into the scheme, successful provision of access for anglers is expected, such that **no residual impact** would occur.

IMPACT: Deterioration of Angling (Fishery Resource)

5.9.7 The proposed scheme incorporates river widening downstream, upstream and within Enniscorthy and lowering high points to consistent, specified design levels. Existing sandbars, such as those alongside the public car park just downstream of the Riverside Park Hotel, will therefore be removed. Present day extremes in flow velocity will be reduced and the resulting changed hydrological regime will increase bed stability and reduce erosion and accretion. Holding pools (caused by erosion from high flow velocities) will experience reduced erosion, likewise, reduced deposition mitigates against sandbar formation in areas where they exist at-present.

5.9.8 Due to their low flow capacity, the bridges within Enniscorthy considerably restrict flood flows. This is due, to a fair degree, by their high inverts (an invert is the level of the riverbed under the bridge). Flow velocities upstream of the bridges are decreased leading to sediment deposition and also velocities are increased, both through and immediately

downstream of the bridges, inducing erosion. For example, the hole in the riverbed immediately downstream of Enniscorthy Bridge is 2.2m lower than the bridge invert.

5.9.9 Fish passage problems can occur at almost any site where water level difference between upstream and downstream of a structure is greater than about 0.5m. The deep pool downstream of Enniscorthy Bridge combined with the high bridge invert produce an obstacle that retains fish during low flow conditions thereby inhibiting them from travelling upstream; a similar situation exists at the railway bridge. These obstructions will be removed by underpinning the bridges to design level, the invert of Enniscorthy Bridge would be lowered by 1.2m and that of the railway bridge by 1m and these would also be paved to reduce erosion and abrasion. Removing this potentially presents difficulty for salmon and trout, and may lead to increased numbers spawning. The existing holes in the riverbed downstream of the bridges will not be filled-in so they should continue to provide their existing function for fish. Should their reduced size result in fish spreading across the river (rather than collecting in certain areas) and this poses a problem, it can be corrected by rehabilitation measures that form an integral part of the scheme. Such works may include the excavation of a talweg (a winding inset flow route) that would offset these negative effects during times of low flow.

5.9.10 Although fish passage under the bridges would improve as a result of these works, the action of removing these obstacles would reduce the size of the holding 'pool' under Enniscorthy Bridge and also reduce the holding time within the town for returning salmon. Using the criteria in **Table 4.6**, the receptor is regional in scale and the magnitude is considered to be medium (due to the extent of improved fish passage through Enniscorthy). Although returning fish numbers could increase as a result of removing obstacles (and so increase numbers successfully spawning) they may no longer remain within the stretch of the Slaney within Enniscorthy. Overall, the improvement in fish passage would result in a **minor positive impact** on the fishery.

IMPACT: Disruption to Recreational and Other Navigation during Operation

5.9.11 High river levels and flows during a flood event preclude recreational navigation activities, due to the potential dangers that may arise, as well as restricted heights between river levels and bridges providing an obstruction.

5.9.12 Recreational navigation on the River Slaney within the Enniscorthy area is limited in size and number of participants, consequently few people would be affected. Disturbance to this resource would occur for the duration of high river levels and flows (i.e. for several days).

5.9.13 Three significant flood events are likely to occur in the next 50 years (OPW, 2004). However, even without the proposed scheme, navigation along the river would still be disturbed or unsafe as a result of storm events. Consequently, **no impact** is expected.

IMPACT: Disruption to Emergency Access

5.9.14 The effect of flooding on emergency access that would otherwise occur if the scheme was not implemented would be prevented. Consequently, a **moderate positive impact** would arise.

5.9.15 The existing river access used by the Slaney Search and Rescue would be lost due to the raising of flood defences and river widening, such that access would be removed. This could result in a **moderate negative impact**. However, OPW intend to provide new access which will be usable at both low and high river levels, and as such reduce this impact to **no residual impact**.

IMPACT: Loss of Amenity Access during Operation

5.9.16 The proposed scheme maintains walkways along or adjacent to the river, and wall heights would only be 1.2m above adjacent ground levels, consequently, there would be no cessation or obstruction to amenity access along the river in any section. Consequently, **no impact** will occur.

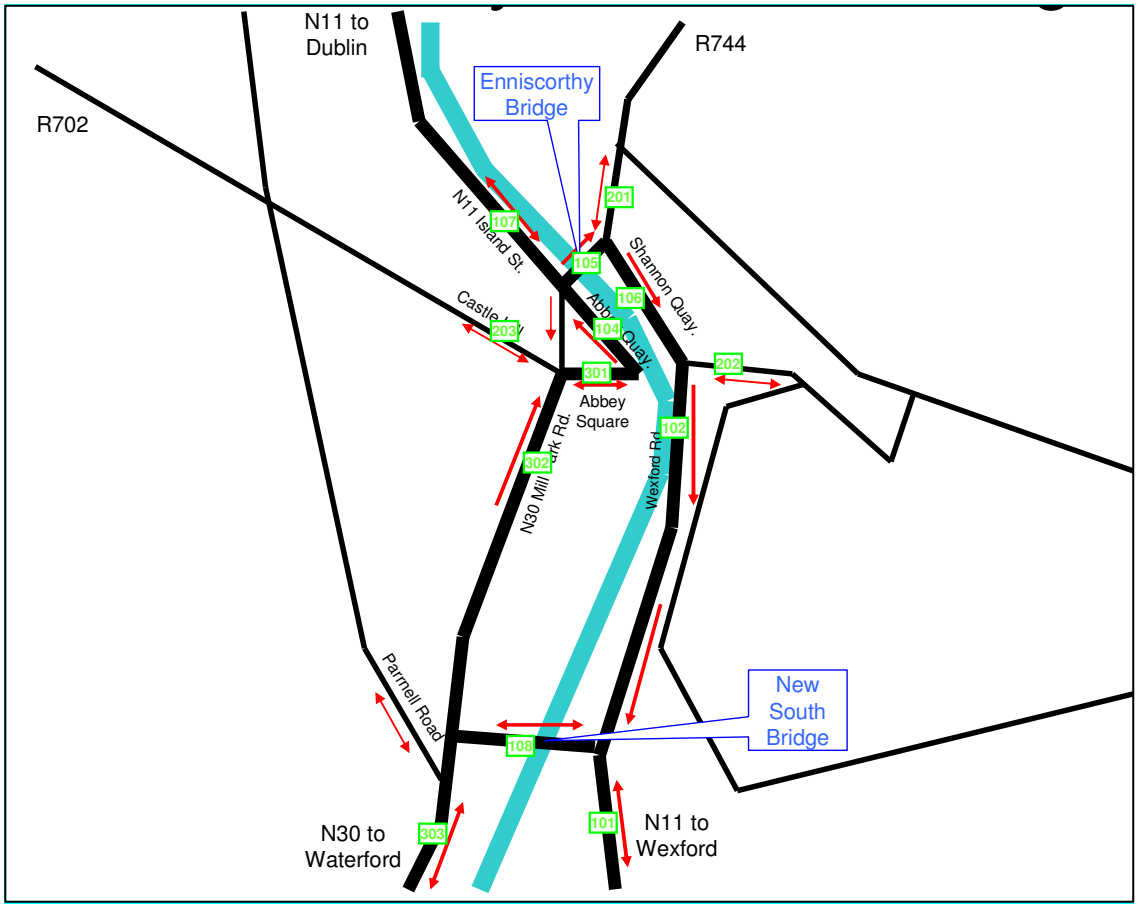
IMPACT: Prevention of Flooding and Disruption to Traffic during Operation

5.9.17 The disturbance to traffic that would otherwise occur if the scheme was not implemented would be prevented, so a **major positive impact** is anticipated from the prevention of flooding of roads within Enniscorthy.

IMPACT: New Bridge and Routing of Traffic

5.9.18 The new bridge would improve the movement of through traffic through the town, particularly traffic passing down the N11 Dublin Road and heading to the N11 Wexford Road or the N30 Waterford Road, as shown on **Figure 5.6.** This would reduce the volume of HCVs within the town centre.

Figure 5.6 Enniscorthy Road Routes with the New Bridge



5.9.19 However, the new bridge and subsequent road routing would require traffic to travel a further distance if they are travelling into the town centre from the N11 Dublin Road, R744, and the Spring Valley Road (see **Figure 5.6**). In addition, further distance would be travelled by vehicles travelling from the R744 and the Spring Valley Road to the N11 Dublin Road or the R702. In total, vehicles would have to travel an additional 1.2km for these routes and travel destinations.

5.9.20 **Table 5.7** and **5.8** present the future AADTs for the various routes in Enniscorthy comparing the "Do Nothing" AADT flows with the proposed scheme AADT flows, due to the new bridge location. **Table 5.9** present the future AADTs with the scheme and also with the Enniscorthy Bypass in place for 2027, to give an indication of the change in traffic in the event of construction of the Bypass.

5.9.21 The following effects may arise on the road network:

- Approximately 1500 vehicles which are currently served by the N11 between Seamus Rafter Bridge and the proposed new bridge during the morning peak hour would now be transferred onto the N30. The road widths along are around 6.5m, however, vehicles parking along this section of the N30 may cause obstruction;
- A school to the west of the N30 accesses the N30 approximately 100m north of the proposed new junction location. Vehicles accessing the school may cause obstruction or delay, or themselves may be obstructed or delayed due to the increased peak hour traffic;
- On the western side of the new bridge, the N30 forms three priority junctions with local and residential roads. The suitability of having three accesses in such close succession onto this section of road could cause congestion;
- The vehicles travelling down the N11 Dublin Road which are intending to go to the town centre will have to travel an additional 1.2km; and
- The provision of a pedestrian/cyclist bridge at the town centre will maintain current pedestrian access, encourage the use of 'soft mode' of transport, and facilitate the making of the town centre more pedestrian friendly area.

5.9.22 Based on the additional distance to be travelled, and the potential congestion at the junctions identified in **paragraph 5.9.21**, compared against the reductions in HCVs through the town centre, the overall effects on local traffic are expected to result in a potential **moderate negative impact**.

Mitigation Measures

5.9.23 The following measures should be examined fully in the Detailed Design Phase, and agreed with the NRA, Wexford County Council, and Enniscorthy Town Council:

- The possibility of providing double yellow lines along the N30 Waterford Road near the new bridge connection and section of the road should be considered in order to prevent possible obstruction and congestion;
- The possibility of relocating the school's access should be considered, in order to prevent obstruction and congestion; and
- The number and type of junction arrangements which would be the most appropriate both from the and onto the new bridge, as well as those junctions in close proximity along the N30; and
- To alleviate the volume of traffic approaching the town from the Dublin Road N11 northern approach and having to perform a 'u-turn' to access the town centre it is proposed to sign-post the town centre from Blackstoops roundabout. The signs should direct traffic to access the town centre via the Summerhill / Nunnery Road.

Table 5.7 Annual Average Daily Traffic in Enniscorthy for 2012 With and Without the Scheme

Road Ref.	Road Segment	Do Nothing				With Scheme			
		Number HCV	Number non-HCV	AADT	%HCV	Number HCV	Number non-HCV	AADT	%HCV
101	Wexford Road south (N11)	1,649	13,012	**14,662**	12.7%	1,649	13,012	**14,662**	12.7%
102	Wexford Road north (N11)	1,649	13,012	**14,662**	12.7%	1,339	15,474	**16,812**	8.7%
103	Seamus Rafter Bridge	1,673	20,740	**22,413**	8.1%				
104	Abbey Quay	1,519	18,824	**20,342**	8.1%	1,519	18,824	**20,342**	8.1%
105	Enniscorthy Bridge	1,631	17,650	**19,282**	9.2%	1,631	17,650	**19,282**	9.2%
106	Shannon Quay	1,339	15,474	**16,812**	8.7%	1,339	15,474	**16,812**	8.7%
107	Island Rd (N11 north)	1,734	17,622	**19,356**	9.8%	1,734	17,622	**19,356**	9.8%
108	New South Bridge					1,673	20,740	**22,413**	8.1%
201	Templeshannon (R744)	572	10,954	**11,526**	5.2%	572	10,954	**11,526**	5.2%
202	Spring Valley	262	5,024	**5,286**	5.2%	262	5,024	**5,286**	5.2%
203	Castle Hill (R702)	483	9,240	**9,722**	5.2%	483	9,240	**9,722**	5.2%
301	Abbey Square	1,510	17,452	**18,962**	8.7%	1,387	17,194	**18,581**	8.1%
302	Mill Park Rd (N30)	1,365	10,060	**11,425**	13.6%	1,764	12,998	**14,762**	13.6%
303	N30	530	5,884	**6,414**	9.0%	530	5,884	**6,414**	9.0%

Table 5.8 Annual Average Daily Traffic in Enniscorthy for 2027 With and Without the Scheme

Road Ref.	Road Segment	Do Nothing				With Scheme			
		Number HCV	Number non-HCV	AADT	%HCV	Number HCV	Number non-HCV	AADT	%HCV
101	Wexford Road south (N11)	2,179	16,403	**18,582**	13.3%	2,179	16,403	**18,582**	13.3%
102	Wexford Road north (N11)	2,179	16,403	**18,582**	13.3%	1,769	19,506	**21,275**	9.1%
103	Seamus Rafter Bridge	2,211	26,144	**28,355**	8.5%				
104	Abbey Quay	2,007	23,728	**25,735**	8.5%	2,007	23,728	**25,735**	8.5%
105	Enniscorthy Bridge	2,156	22,249	**24,405**	9.7%	2,156	22,249	**24,405**	9.7%
106	Shannon Quay	1,769	19,506	**21,275**	9.1%	1,769	19,506	**21,275**	9.1%
107	Island Rd (N11 north)	2,291	22,214	**24,505**	10.3%	2,291	22,214	**24,505**	10.3%
108	New South Bridge					2,211	26,144	**28,355**	8.5%
201	Tempshannon (R744)	665	12,519	**13,184**	5.3%	665	12,519	**13,184**	5.3%
202	Spring Valley	305	5,742	**6,047**	5.3%	305	5,742	**6,047**	5.3%
203	Castle Hill (R702)	561	10,560	**11,121**	5.3%	561	10,560	**11,121**	5.3%
301	Abbey Square	1,995	21,999	**23,995**	9.1%	1,833	21,674	**23,506**	8.5%
302	Mill Park Rd (N30)	1,804	12,682	**14,485**	14.2%	2,330	16,385	**18,716**	14.2%
303	N30	700	7,418	**8,118**	9.4%	700	7,418	**8,118**	9.4%

Table 5.9 Annual Average Daily Traffic in Enniscorthy for 2027 With and Without the Scheme

Road Ref.	Road Segment	With Scheme				With Scheme and Bypass			
		Number HCV	Number non-HCV	AADT	%HCV	Number HCV	Number non-HCV	AADT	%HCV
101	Wexford Road south (N11)	2,179	16,403	**18,582**	13.3%	2,753	17,966	**20,719**	13.3%
102	Wexford Road north (N11)	1,769	19,506	**21,275**	9.1%	1,544	15,476	**17,020**	9.1%
104	Abbey Quay	2,007	23,728	**25,735**	8.5%	1,741	18,847	**20,588**	8.5%
105	Enniscorthy Bridge	2,156	22,249	**24,405**	9.7%	1,932	18,007	**19,939**	9.7%
106	Shannon Quay	1,769	19,506	**21,275**	9.1%	1,544	15,476	**17,020**	9.1%
107	Island Rd (N11 north)	2,291	22,214	**24,505**	10.3%	293	2,549	**2,843**	10.3%
108	New South Bridge	2,211	26,144	**28,355**	8.5%	1,856	20,091	**21,947**	8.5%
201	Templeshannon (R744)	665	12,519	**13,184**	5.3%	701	12,484	**13,184**	5.3%
202	Spring Valley	305	5,742	**6,047**	5.3%	321	5,725	**6,047**	5.3%
203	Castle Hill (R702)	561	10,560	**11,121**	5.3%	591	10,530	**11,121**	5.3%
301	Abbey Square	1,833	21,674	**23,506**	8.5%	1,590	17,215	**18,805**	8.5%
302	Mill Park Rd (N30)	2,330	16,385	**18,716**	14.2%	2,130	12,843	**14,973**	14.2%
303	N30	700	7,418	**8,118**	9.4%	809	7,756	**8,565**	9.4%

Residual Impact

5.9.24 By detailed analysis, modelling and design of junctions and other road traffic measures as identified in **paragraph 5.9.23**, the likelihood of congestion would be reduced and the number of vehicles having to travel an additional 1.2km would also be reduced. However, given that some local traffic will still have an addition 1.2km to travel, which although of low magnitude increases with the number of cars travelling each day. Consequently, a **minor negative impact** on traffic is expected as a result of the new bridge as a part of the proposed scheme.

5.10 Monitoring

5.10.1 Should the salmon fishery re-open in the future years after 2009, the monitoring of fish catches should be undertaken. This could be carried out by contacting the local fishing clubs and owners, and yearly (for a period of three years) after construction is completed a meeting will be held with the interested groups to ensure that no significant changes have occurred. Consultation should also include the ERFB, whose monitoring would also be included in the discussions. If a significant deterioration in salmon numbers in particular is recorded, in cooperation with the ERFB, the OPW would undertake to study the problem and undertake corrective works if related to specific aspects of the proposed scheme.

5.10.2 Following the completion of the bridge and road works, traffic counts and should be undertaken to ensure that there are no unexpected areas of congestion in the road traffic network. The work should be undertaken in co-ordination with Wexford County Council, who has the traffic model and previous count data.

6 FLORA

6.1 Introduction

6.1.1 This section examines the habitats and flora within the study area, and the potential effects of the proposed scheme on them during construction and operation.

6.2 Assessment Methodology

6.2.1 There is no specific assessment methodology relative to the attributes under this heading, consequently, the methodology for the assessment of significance is that described in **Section 4.6**. The conservation objectives available for the cSAC habitats are used to assess the potential impacts on the cSAC as a result of the scheme, these are detailed in **Appendix 5** (the Appropriate Assessment).

6.3 Data Collection

6.3.1 The data collected for this EIS was principally survey data (see below).

6.4 Surveys

6.4.1 A number of surveys were undertaken, namely:

- Habitat Survey undertaken in 2003 (see **Figures 6.1** and **6.2** and the detailed survey report in **Appendix 6**); and
- *Callitriche* Survey undertaken in 2003 (see **Appendix 7**).

6.5 Consultation

6.5.1 Consultation was undertaken with the Department of Environment, Heritage and Local Government with respect to the impacts on the designated cSAC.

6.6 Baseline Environment

Habitat Description

6.6.1 Upstream of Enniscorthy the floodplain is predominantly neutral grassland with a fringe of tall herbs and willows overhanging the river (see **Figure 6.1**). There is also evidence of more intensive use with the presence of arable crops (*Lolium* pasture) on the right bank. Stream water crowfoot (*Ranunculus penicilatus*) is present within a riffle (point 2 on **Figure 6.1**); this is one of the several *Ranunculus* species that comprise the 'floating river vegetation' habitat named within the cSAC designation. Just upstream of Enniscorthy is a narrow fringe of tree covered ground beneath a steep slope of mixed woodland including oak, beech and sycamore.

6.6.2 Immediately downstream of Enniscorthy the floodplain is again typically neutral grassland, with occasional patches of broadleaf woodland. South of the confluence with the River Urrin, vegetation changes from neutral grassland to wet grassland with occasional areas of riparian woodland and wet willow/alder/ash woodland (see **Figure 6.2**). Downstream of the River Boro confluence the wet grassland gives way to tall herb swamp with patches of wet willow/alder/ash woodland.

Figure 6.1 Habitat Survey for Enniscorthy Area

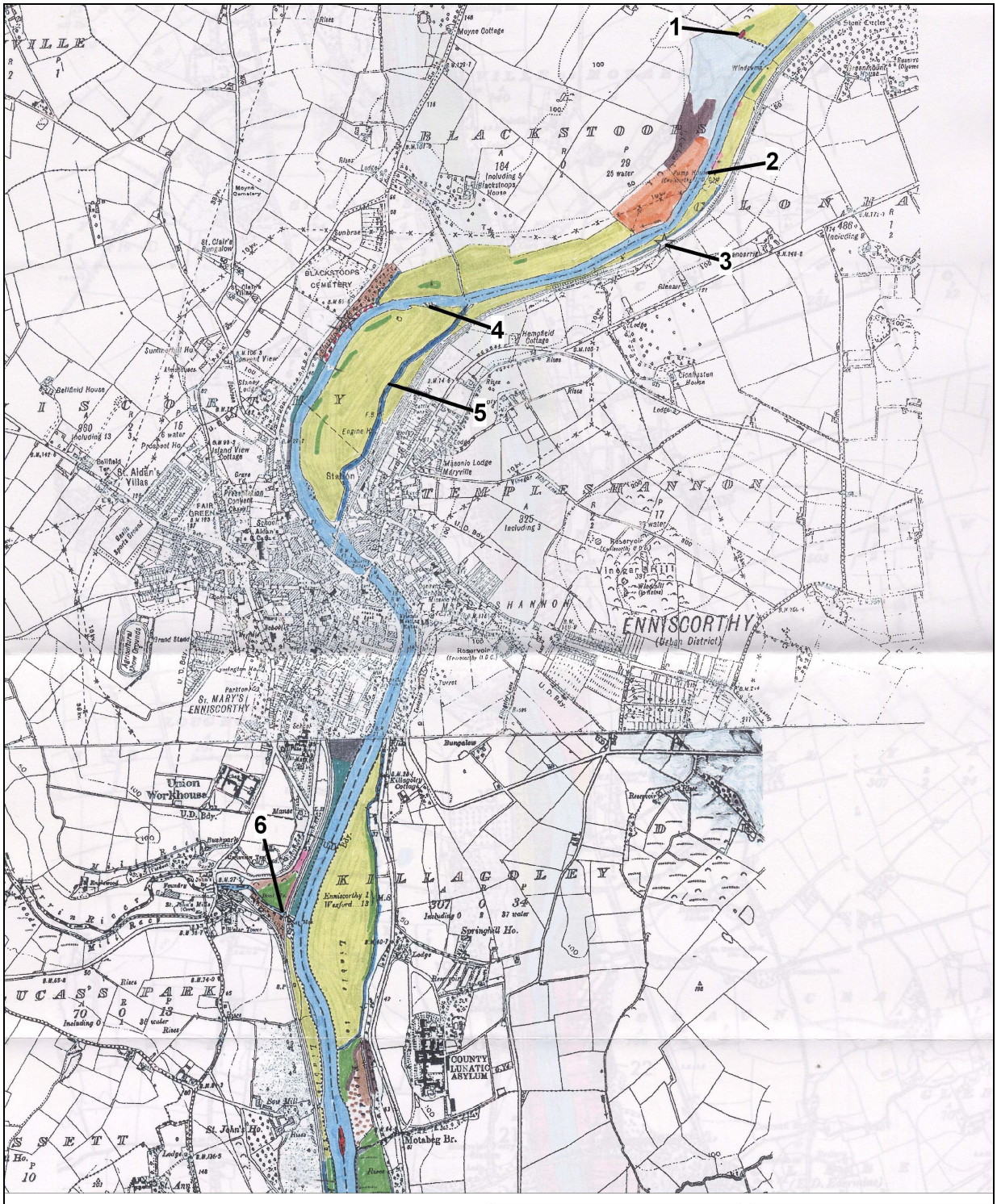
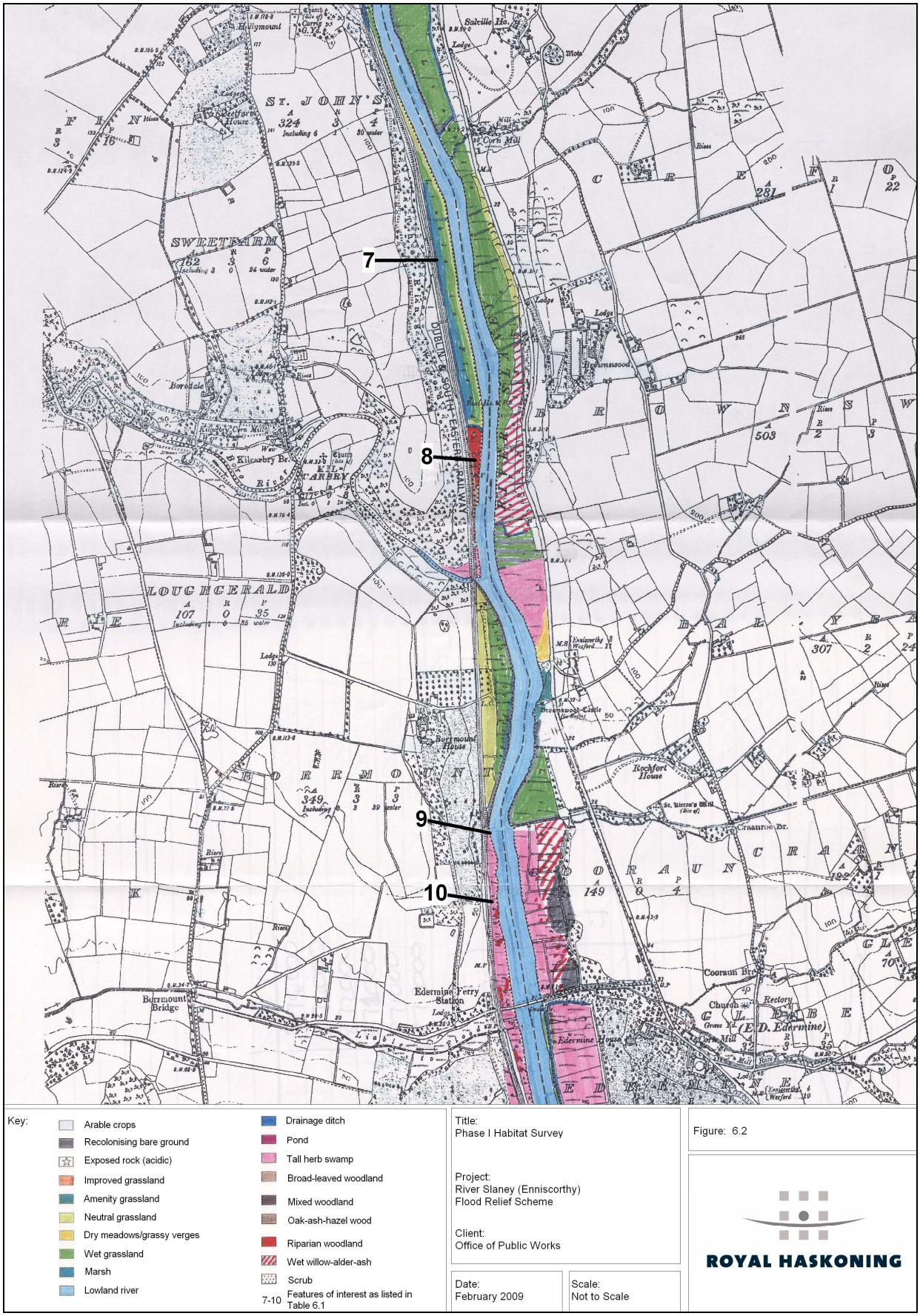


Figure 6.2 Habitat Survey for Area South of Enniscorthy



6.6.3 The Phase I Habitat Survey also identified short-leaved water-starwort (*Callitriche truncata*) upstream of Edermine Bridge (Point 9 on **Figure 6.2**) and as detailed previously this is legally protected under the Flora Protection Order, 1999.

6.6.4 **Table 6.1** highlights the features of interest that were identified during the Phase I habitat survey. These are also highlighted on **Figures 6.1** and **6.2**.

Table 6.1 Features of Habitat and Species Interest

No.	Site description	Feature(s)
1	Small pond below Kilcannon House	Centre for biodiversity and floodplain plants.
2	Riffle	Contains stream water crowfoot (*Ranunculus penicillatus)*.
3	Rock outcrop in Lonhasten	Some plant species of interest as well as visual feature.
4	Riffle	Feeding station for insectivores.
5	Back channel below station	Richest aquatic flora within study area.
6	Urrin confluence	Good bat habitat.
7	Marsh below The Ring Wood	Quaking swamp with the beginnings of tree colonisation.
8	Flooded woodland just north of Boro	Good variety of willows and other trees. Greater broomrape (*Orobanche rapum-genistae*), a rare species but growing inside railway.
9	Mudflats below Borrmount House	Contains rare and protected short-leaved water-starwort (*Callitriche truncata*).
10	Tall herb stands around Edermine Bridge (including wet woodland on the eastern side)	Semi-natural floodplain vegetation developing well in the absence of grazing (good associated bird fauna).

Ballynabarney Wood, Natural Heritage Area

6.6.5 Natural Heritage Areas (NHAs) are sites of national importance for their flora, fauna, geological or physiographic interest. They are part of the strategic network of areas originally identified by An Foras Forbartha as Areas of Scientific Interest. There are approximately 1,200 NHAs in Ireland (750,000 ha).

6.6.6 Ballynabarney Wood is secondary woodland that to a large extent has been allowed to develop naturally, and as such is a rare and valuable habitat in Ireland, Europe's least wooded country. It is situated approximately 2km north-east of Enniscorthy and approximately 1km east of the Constraints Study Area (see **Figure 6.3**).

6.6.7 **Appendix 8** presents the citation for this site. The site comprises deciduous woodland that occurs where the river valley is steep, dominated by hazel (*Corylus avellana*) in the north and oak (*Quercus* sp.) in the south. Former felling of the larger trees has resulted in the oaks being young and all under 12m in height. Beside the river itself, which occupies a broad anastomosing channel in the winter, willows (*Salix cinerea, S. caprea*) are common and there is some spindle tree (*Euonymus europaeus*) also. The clayey soil is acid in reaction and so the ground flora is restricted in variety. However, the river deposits silt along its banks and a large variety of different herb species occur here.

Greenville, proposed Natural Heritage Area

6.6.8 There is one site at Greenville townland that is within 1km of the study area and has been recommended for designation as a NHA, on account of its potential value as a source of Precambrian to Devonian age palaeontology. The site lies 1km north of Enniscorthy (Grid Reference 296300 141400, well outside the area of potential impact of the proposed scheme and its construction works, see **Figure 6.3**.

Slaney Valley cSAC

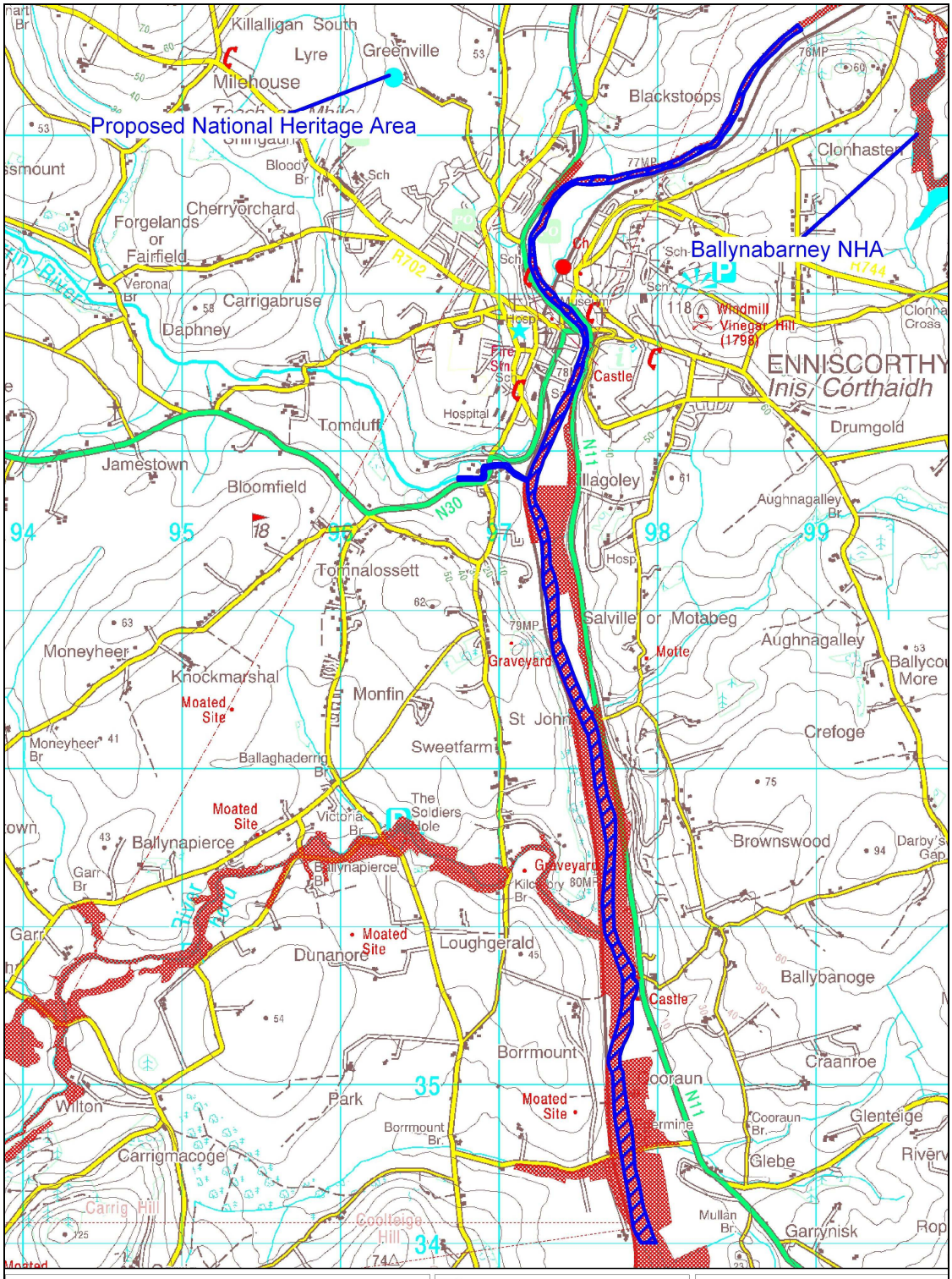
6.6.9 The Slaney Valley is designated as a cSAC. SACs are areas of special importance for wildlife, habitats and species, and form part of the Irish contribution to the EU Natura 2000 network, within which Member States are required to establish ecologically important sites under the EU Habitats Directive (92/43/EEC). The Directive lists priority habitats and species, which must be conserved. **Appendix 9** presents the citation for the Slaney Valley cSAC.

6.6.10 The cSAC designation comprises the mid and lower reaches of the River Slaney from below Tullow at Aghade Bridge, passing through Bunclody and Enniscorthy to the estuary at Ferrycarrig and includes all of the study area, with the exception of the short stretch of the River Urin. The river is up to 100m wide in places and is tidal at the southern end from Edermine Bridge to Enniscorthy. The tidal and freshwater boundary defined under Section 10 of the Fisheries (Consolidation) Act 1959, is the Old Bridge in Enniscorthy (Enniscorthy Bridge). Although the tidal limit is Enniscorthy Bridge there is not a great tidal range this far upstream. As a result there is very little that is considered as estuary or mudflat within the study area. The extent of the cSAC through the study area can be seen in **Figure 6.3**.

6.6.11 The cSAC supports three habitats listed in Annex I of the EU Habitats Directive, estuaries, tidal mudflats, and floating river vegetation. The site is further selected for the following species listed in Annex II of the same directive - sea lamprey (*Petromyzon marinus*), river lamprey (*Lampetra fluviatilis*), brook lamprey (*Lampetra planeri*), freshwater pearl mussel (*Margaritifera margaritifera*), twaite shad (*Alosa fallax fallax*), Atlantic salmon (*Salmo salar*), and otter (*Lutra lutra*).

6.6.12 The cSAC designation for the mid and lower reaches of the River Slaney highlights the river as a very good example of the extreme upper reaches of an estuary. Tidal reedbeds with wet woodland are present in places. Good examples of wet woodland are found associated with Macmine marshes (approximately 2km downstream of Edermine Bridge), along the banks of the Slaney and its tributaries and within reed swamps. Below Enniscorthy there are several areas of woodland with a mixed canopy of oak (*Quercus* sp.), beech (*Fagus sylvatica*), sycamore (*Acer pseudoplatanus*), ash (*Fraxinus excelsior*) and generally a good diverse ground flora.

Figure 6.3 Designated Sites within and Adjacent to the Study Area



Rare and Protected Species

6.6.13 Two rare aquatic plant species are also noted within the cSAC designation: short-leaved water-starwort (*Callitriche truncata*) a very rare, small aquatic herb found nowhere else in Ireland, and opposite-leaved pondweed (*Groenlandia densa*), both species are legally protected under the Flora Protection Order, 1999.

6.6.14 The Phase I Habitat Survey also identified short-leaved water-starwort (*Callitriche truncata*) upstream of Edermine Bridge (Point 9 on **Figure 6.2**). This species is also legally protected under the Flora Protection Order, 1999.

6.7 Do Nothing Scenario

Terrestrial Habitat

6.7.1 Infrequent flooding occurs within the study area, but this is unlikely to result in any significant changes in habitat and flora over the wider area.

Aquatic and Riverine Habitat

6.7.2 Infrequent flooding occurs within the study area, but this is unlikely to result in any significant changes to the hydrological regime and subsequent aquatic and riverine habitat over the wider area.

6.7.3 Climate change effects could result in significant localised alterations to the riverine flora, particularly where hydrological changes (water levels) occur between seasons. Seasonal changes in water levels would effect existing flora and result in changes in the diversity and density of aquatic species, though particularly bank side species.

Protected Species

6.7.4 The existing hydrological regime would not change and no additional disturbance above current activities is expected.

6.8 Potential Environmental Impacts during Construction

IMPACT: Disturbance to Designated Sites during Construction

6.8.1 The boundary of the Slaney Valley cSAC runs along the flood plain through Enniscorthy and its environs (see **Figure 6.3**). The installation of fixed defences throughout the riverside in Enniscorthy would occur within the cSAC boundary, resulting in construction disturbance in the floodplain. The cSAC is designated for specific habitats (estuaries, mudflats and floating river vegetation) and species (sea lamprey, river lamprey, brook lamprey, freshwater pearl mussel, twaite shad, allis shad, Atlantic salmon, and otter). No habitats are significantly affected by the direct construction works, and the species for which the site is designated would be affected by indirect disturbance (noise, increased human activity, increased levels of suspended sediment).

6.8.2 Impacts to the qualifying features of the Slaney Valley cSAC are determined in the Appropriate Assessment (see **Appendix 5** for further details). A summary of the findings of the Appropriate Assessment are presented in **Table 6.2** below.

Table 6.2 Summary of Appropriate Assessment

Feature	Impact
Migratory fish features (*Salmo salar, Alosa fallax, Alosa alosa, Petromyzon marinus, Lampetra fluviatilis, Lampetra planeri*)	Short-term minor negative impact resulting from construction activities.
Otter (*Lutra lutra*)	Short-term reversible negligible impact through disturbance to two holts and disruption to foraging access.
Floating vegetation	Short-term reversible negligible impact arising from re-suspension of sediments during construction and no impact during operation.
Old sessile oak woodlands	No impact.

IMPACT: Disturbance to Terrestrial Habitat during Construction

6.8.3 The heavy machinery required to construct defence structures along much of the riverbank within Enniscorthy would cause a direct disturbance to terrestrial habitats alongside the river. There is, however, limited riverbank habitat of note as most of the proposed works are on existing walls alongside roads. The area between the two main bridges is tree-lined and includes ornamental planting. However, none of this habitat could be described as rare or locally important.

6.8.4 Placement of material from dredging and river widening to control flood flows in the floodplain to the north of Enniscorthy is proposed in the meadow alongside the railway line. This results in the smothering of large areas of terrestrial habitat. These are areas of neutral grassland, a habitat type that is widespread in the local area. Using the criteria described within **Table 4.6**, the sensitivity of the receptor is considered low/local. However, the additional habitat will be lost upstream of Enniscorthy means that the magnitude of the effect would be medium. The areas identified for the placement of flood control bunds would be reinstated to grassland status through grass seeding.

6.8.5 Overall, therefore, a short-term **minor negative impact** is anticipated.

IMPACT: Disturbance to Aquatic Habitat during Construction

6.8.6 The proposed channel deepening, re-grading and intermittent widening will occur from 400m downstream of the Seamus Rafter Bridge to approximately 1.5km upstream and constitutes major in-river works. All of this could potentially result in aquatic flora and fauna being directly impacted by vehicles tracking within the river. Provided works take place outside sensitive seasons, the impact would be minimised, and would generally occur in a localised area at any one time. As the sensitivity of the receptor is low and the magnitude of the effect is low (due to the localised area of disturbance at any given time), a short-term **minor negative impact** is anticipated.

IMPACT: Disturbance to Protected Species

6.8.7 Aquatic surveys identified the presence of short-leaved water starwort (*Callitriche truncata*) as far upstream as Borrmount (approximately 0.5km downstream of the confluence of the River Boro). This species is protected under the Flora Protection Order, 1999 and is considered an extremely rare species found only in the tidal reaches of the River Slaney.

6.8.8 The nearest construction works are approximately 3km upstream of the nearest known population of short-leaved water starwort and, as such, it is unlikely that any works would directly or indirectly affect its existing distribution. Consequently, **no impact** is anticipated.

6.9 Potential Environmental Impacts during Operation

IMPACT: Disturbance to Designated Sites during Operation

6.9.1 In the 1.5km stretch upstream of the Seamus Rafter Bridge, the river-widening design depth is such that a berm is formed while the existing river width is maintained due to its lower depths. A flood alleviation channel will be created 400m downstream of the Seamus Rafter Bridge, extending 1.25km downstream. Low flows with various combinations of tidal influence would be held within the present-day river so water depth and velocity should not significantly change from present-day. Medium to high flows with various combinations of tidal influence will flood out onto the berm and/ or into the flood alleviation channel. Remedial measures will include planting of appropriate soft vegetation.

6.9.2 Floods can produce dramatic erosion and accretion on the River Slaney that could cause failure of a flood relief scheme; this important issue needs addressing. Estimated flood velocity changes mainly show a 10% drop throughout the town and about a 20% drop in the area upstream of Enniscorthy thereby producing an overall effect of lower velocities in this upstream area than within the town. This velocity set-up ensures that sediment load transported from further upstream will either deposit out in this upstream stretch or will be safely transported through the town by its higher velocities. The proposed scheme removes the risk of failure of the scheme at flows smaller than the design flow from sediment build-up within the town and so the identified changes remove a potentially significant impact.

6.9.3 At the upstream extent of the scheme (approximately 1.5 km upstream of the town), a “Sediment Trap” is to be constructed to remove transported sediment before it enters the scheme area. This is likely to take the form of a wide short stretch of river with large boulders capable of dissipating floodwater energy. This trap also means that sediment removal will be mainly located at its site thereby reducing the impact of future scheme maintenance.

6.9.4 The increased river stability reduces the formation of barriers to fish migration during low flow periods and this, in turn, potentially leads to increasing numbers spawning. The impact from this scheme is likely to be an increase in the fishery resource that could also have knock-on effects for otters.

6.9.5 Overall, there would be no loss of cSAC habitat, or deterioration in the quality of the cSAC for its qualifying species. The incorporation of berms and new channel throughout this length would also increase the habitat available for otter, whilst the stabilisation of in-stream habitat is expected to maintain clear and obstacle free movement of salmon upstream and downstream of the river, and a **minor positive impact** is predicted.

IMPACT: Loss of Terrestrial Habitat

6.9.6 The following works will result in the permanent loss of neutral grassland habitats:

- A 1.25km flood relief channel will be created downstream of Enniscorthy (see **Figure 3. 4**). This will be approximately 33m wide, resulting in a loss of up to 4.2ha of neutral grassland;
- A 210m long road bridge will be constructed over the River Slaney downstream of Enniscorthy (see **Figure 3.8**). This will be located 100m downstream of the Riverside Park Hotel (Grid Reference 297260 139220 to Grid Reference 297455 139180). The bridge support and tie-in to the road will result in the loss of up to 0.3ha of grassland; and
- Dredging and widening works are proposed along 1.25km upstream of the town (see **Figure 3.15**). This will result in the loss of approximately 2.5ha of neutral grassland.

6.9.7 In total, up to 7ha of neutral grassland habitat will be permanently lost. As shown on **Figures 6.1 and 6.2** this habitat type is widespread in the area. Using the criteria described within **Table 4.6**, the sensitivity of the receptor is considered low/local. However, the total area of habitat lost means that the magnitude of the effect would be medium; therefore, a permanent **minor negative impact** is predicted.

6.9.8 Upstream of Enniscorthy dredged materials are to be used to create flood flow deflection bunds. These will be returned to grassland status through remedial measures; including grass seeding as identified above during the construction phase, this will mitigate the loss of 2.5ha for the river widening. After mitigation there will still be a loss of 4.5ha of neutral grassland with a residual **minor negative impact**.

IMPACT: Gain of Aquatic Habitat

6.9.9 River widening on the 1.25km stretch immediately upstream of the town converts areas of existing floodplain (neutral grassland) to a new berm area of aquatic habitat. Medium to high flows with various combinations of tidal influence will flood out onto this berm thereby providing an opportunity for lamprey spawning, etc. Remedial measures will include the planting of appropriate soft vegetation.

6.9.10 The 1.25km flood alleviation channel will carry a sweetening flow at all times and will carry flood flows during high rainfall events. This will be planted with soft vegetation as described in **paragraph 6.9.9**.

6.9.11 As such, these measures represent a potential improvement to habitat and flora as the incorporation of berms throughout this length would increase habitat diversity and therefore represents a **minor positive impact**.

6.10 Monitoring

6.10.1 A habitat survey is to be undertaken one year after construction is completed to ensure that habitat and flora species are responding and re-colonising appropriately. Monitoring of features related to the cSAC are focussed on the faunal species which exploit the habitat (namely fish species and otter) and monitoring for these is proposed in **Section 7.10**.

7 FAUNA

7.1 Introduction

7.1.1 This section examines the various species of fauna within the study area, and the potential effects of the proposed scheme on them during construction and operation.

7.2 Assessment Methodology

7.2.1 There is no specific assessment methodology relative to the attributes under this heading, consequently, the methodology for the assessment of significance is that described in **Section 4.6**. However, where species are protected, the level of protection and importance placed on species or habitats will be accorded the same level within the EIS.

7.3 Data Collection

7.3.1 The data collected for this EIS was principally survey data (see below).

7.4 Surveys

7.4.1 A Habitat Survey (see **Appendix 6**) and a Mammal Survey (**Appendix 10**) were undertaken across the study area in 2003 and 2005 respectively. The habitat survey noted locations of breeding birds where observed on site

7.5 Consultation

7.5.1 Consultation was undertaken with the Department of Environment, Heritage and Local Government with respect to the impacts on the designated Slaney Valley cSAC and its associated species, as well as with the Eastern Regional Fisheries Board regarding fish species, and salmon in particular.

7.6 Baseline Environment

Protected Species

7.6.1 The cSAC designation identifies several mammal species occurring between Tullow and Ferrycarrig including otter, which is listed in Annex II of the EU Habitats Directive and several species listed in the Irish Red Data Book including pine marten (*Martes martes*), badger (*Meles meles*), Irish hare (*Lepus timidus*) and Daubenton's bat (*Myotis daubentonii*). Common frog (*Rana temporaria*), another Red Data Book species, also features within the designation.

Badger

7.6.2 The July 2003 Habitat Survey identified no signs of badger activity along or immediately adjacent to the River Slaney within the study area. Signs of badger were specifically searched for during the 2005 Mammal Survey. No badger setts were identified within the area to be directly affected by the flood defence scheme. Several badger setts, latrines and signs of foraging were identified in the wider study area.

Otter

7.6.3 Otter signs were identified during the 2003 Habitat Survey in the grassland area north of the town centre and areas of potential habitat were identified upstream of Enniscorthy, and upstream and downstream of the confluence with the River Boro (see **Figures 7.1**). The 2005 Mammal Survey identified otter spraints, paw prints, tracks, and three holts in the study area; one on the grassland to the north west of the Rail Bridge, and two on a small tributary of the River Slaney adjacent to the hospital (see **Figures 7.1 and 7.2**). In addition to this, there are anecdotal sightings of otter in the urban stretches of the River Slaney that suggest that otter are widespread throughout the study area.

7.6.4 The otter is listed in the Bern Convention and the Convention International Trade of Endangered Species (CITES), as well as being listed in Annex II of the EU Habitats Directive.

Bats

7.6.5 Several areas were identified as potentially supporting bats during the Habitat Survey, including a group of old buildings near the mouth of the Urrin River. A riffle at the upstream limit of the proposed works (Point 4 on **Figure 6.1**), which already attracts several insectivorous species including sand martins (*Riparia riparia*), was also considered to potentially support Daubenton's bat (an Irish Red Data Book species and part of the cSAC designation).

7.6.6 The 2005 Mammal Survey included overnight monitoring of bat activity to determine roost locations and foraging habitat. Observations were made of the following species: Daubenton's bat (*Myotis daubentoni*); Soprano pipistrelle (*Pipistrellus pygmaeus*); Common pipistrelle (*P. pipistrellus*) and Leisler's bat (*Nyctalus leisleri*). Detailed survey accounts are given in **Appendix 10**.

7.6.7 Anecdotal sightings of brown long-eared bats and whiskered bats are reported along the River Slaney at Edermine House south of Enniscorthy. It is likely that species such as Natterer's bat are also present close to or along the River Slaney.

7.6.8 Several bat roosts were identified during the 2005 Mammal Survey; none of these are located within structures that will be removed to allow the scheme to be constructed. Trees which line the drain adjacent to the railway station have high potential to support bats.

7.6.9 All bats are afforded protection under Annex IV of the EU Habitats Directive and are also protected under the Wildlife Act, 1976, whereby it is an offence to intentionally kill, disturb, handle or keep bats without a licence.

Ornithology

7.6.10 The Phase 1 Habitat Survey (July 2003) identified various areas of interest for several species of birds of conservation concern. Upstream of Enniscorthy (Grid Reference 297300 140500) the left bank contains a small colony of sand martins (approximately 12 active nests, refer to Point 2 on **Figure 7.1**). Sand martins are listed in the amber list (medium conservation concern) of Bird Watch Ireland's priority bird species. As the bank is of sandy material it could also support kingfisher (*Alcedo atthis*). A kingfisher was seen on the main channel at the same site and is also listed in Bird Watch Ireland's amber list of bird species. A single yellowhammer (*Emberiza citrinella*) (a red list species – of high

conservation concern) was also heard singing at Grid Reference 298600 141600 (see **Figure 7.1**).

7.6.11 The cSAC designation highlights important numbers of birds for the mid and lower reaches of the River Slaney in winter. Little egret (*Egretta garzetta*) are found annually along the river. This bird is only now beginning to gain a foothold in Ireland and the south-east appears to be its stronghold. Nationally important numbers of black-tailed godwit (*Limosa limosa*), teal (*Anas crecca*), tufted duck (*Aythya fuliguli*), mute swan (*Cygnus olor*), little grebe (*Tachybaptus ruficollis*) and black-headed gull (*Larus ridibundus*) are found along the estuarine stretch of the river. The mean of the maximum counts over four winters (1994/98) along the stretch between Enniscorthy and Ferrycarrig is shown in **Table 7.1**.

7.6.12 The reed warbler (*Acrocephalus scirpaceus*), which is a scarce breeding species in Ireland, is regularly found in Macmine Marshes (approximately 2km south of Edermine Bridge) but it has not been identified as breeding within Enniscorthy or immediately upstream or downstream of the study area. Dipper (*Cinclus cinclus*) also occurs on the river and is a declining species nationally.

Table 7.1 Mean Maximum Bird Counts over 4 years (1994/1998) between Enniscorthy and Ferrycarrig (Dúchas, 1999)

Species	Mean Maximum Count
Little egret (*Egretta garzetta*)	6
Golden plover (*Pluvialis apricaria*)	6
Wigeon (*Anas penelope*)	139
Teal (*Anas crecca*)	429
Mallard (*Anas platyrhynchos*)	265
Tufted duck (*Aythya fuliguli*)	171
Lapwing (*Vanellus vanellus*)	603
Shelduck (*Tadorna tadorna*)	16
Black-tailed godwit (*Limosa limosa*)	93
Curlew (*Numenius arquata*)	81
Red-breasted merganser (*Mergus serrator*)	11
Black-headed gull (*Larus ridibundus*)	3,030
Goldeneye (*Bucephala clangula*)	45
Oystercatcher (*Haematopus ostralegus*)	19
Redshank (*Tringa totanus*)	65
Lesser black-backed gull (*Larus fuscus*)	727
Herring gull (*Larus argentatus*)	179
Common gull (*Larus canus*)	67
Grey heron (*Ardea cinerea*)	39
Mute swan (*Cygnus olor*)	259
Little grebe (*Tachybaptus ruficollis*)	17

Figure 7.1 Protected Species in the Enniscorthy Area

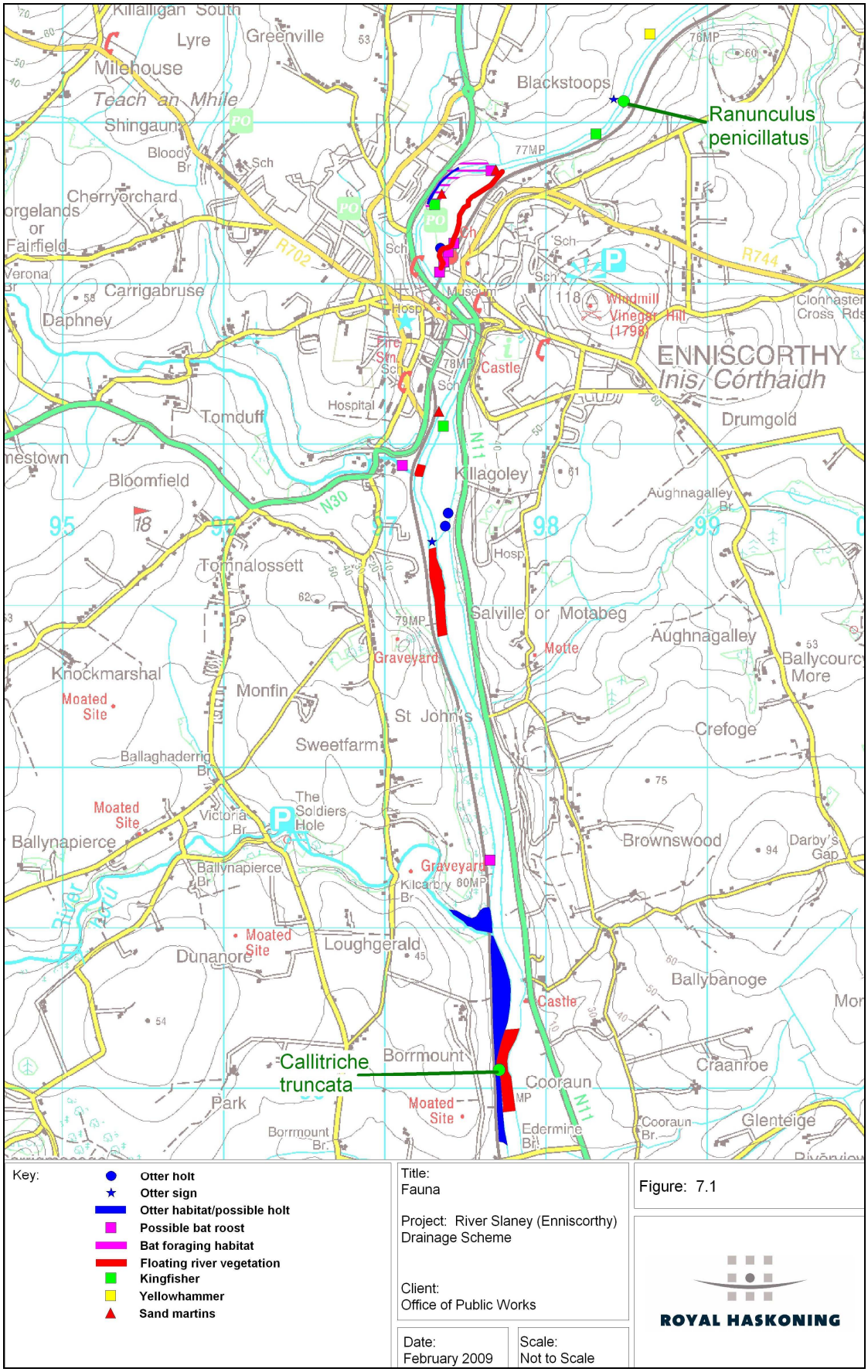
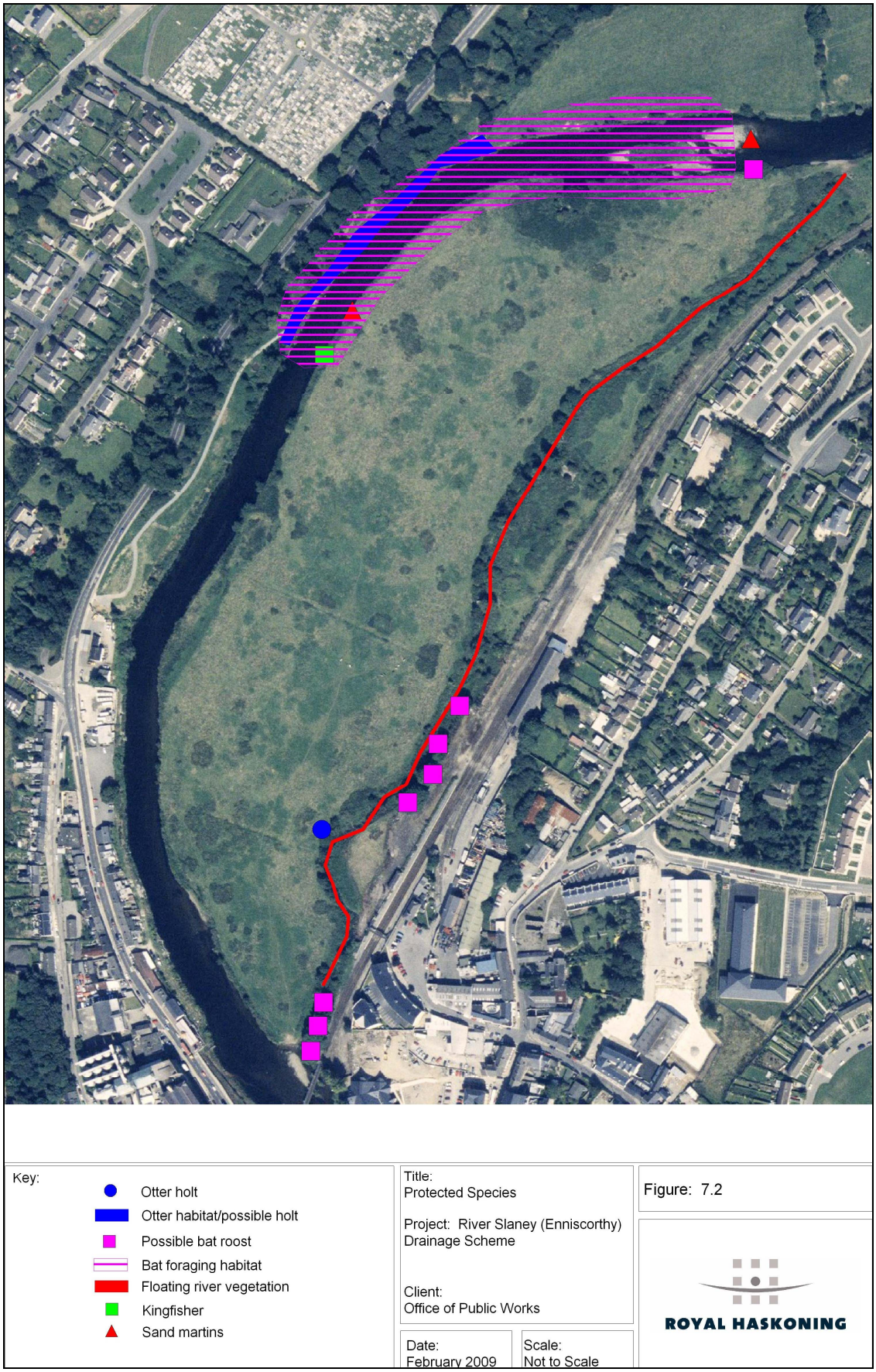


Figure 7.2 Protected Species Sites upstream of the Railway Bridge, Enniscorthy



Fish

7.6.13 The River Slaney is an important spring salmon (*Salmo salar*) fishery with large numbers of multi sea winter (msw) fish returning from the sea between February and April. The majority of these fish swim upstream to grounds in the headwaters where spawning takes place in early winter. After hatching, the juvenile fish remain within the gravel for up to six weeks. When they are between one and four years old (usually two years old) the fish are ready to migrate to sea as smolts and run to sea between April and June. All the above life stages of salmon would be present within the river, where potential spawning grounds occur both above and below Enniscorthy Bridge (refer to **Figure 5.1**). A later summer run of mainly one sea winter salmon (1sw) also return between June and August.

7.6.14 Upstream of Enniscorthly is also good spawning and nursery habitat for river/sea/brook lamprey. According to the National Parks and Wildlife Service (NPWS) database of rare and protected aquatic species, and King and Linnane (2004), all three lamprey species have been recorded within the River Slaney. There are two records of river lamprey and one of sea lamprey downstream of the proposed scheme, and an additional record exists from the confluence of the River Boro and the River Slaney. Sea lamprey have been recorded spawning downstream of the bridge in Enniscorthy (King and Linnane, 2004) and may spawn in the vicinity of the Waste Water Treatment Plant (WWTP) (ERFB, *pers. comm.*, 2009). The flow regime downstream of the outfall is primarily glide and pool with a small area of riffle at a point approximately 500m below the outfall which may offer some suitable spawning habitat.

7.6.15 Allis shad, twaite shad, and smelt have been recorded within the River Slaney (King and Linnane, 2004), though there are no indications as to the location of their spawning grounds (*ibid*, ERFB *pers. comm.*). These species typically spawn at the upper tidal area of rivers, and therefore all three species may spawn in the vicinity of the WWTP. Historically, the River Slaney is known to have held large populations of shad (King and Linnane, 2004). Twaite shad are known to spawn in the study area, with allis shad spawning further upstream of the study area. Smelt can also be found within the River Slaney system, spawning at the top of the tide.

7.6.16 The River Slaney is also an important sea trout (*Salmo trutta*) fishery with large numbers returning to the Rivers Slaney, Boro and Urrin Rivers from mid June to August. These fish swim upstream to spawning grounds where spawning occurs in early winter. After hatching, the juvenile fish remain within the gravel for up to six weeks; between one and four years old (usually two years old) the fish are ready to migrate to sea as smolts and run to sea between April and June.

7.6.17 Brown trout (*Salmo trutta*) are also found throughout the catchment and are present through much of the study area. Brown trout are a purely freshwater species but will follow the same spawning and life stages as sea trout. All stages of the life cycle of sea trout and brown trout are present within the study area. Lampreys are also considered to spawn within the study area (ERFB, *pers. comm.,* 2003). **Table 7.2** indicates the sensitive times of the year with regard to fish and eel migration.

Freshwater Pearl Mussel

7.6.18 The nearest populations of freshwater pearl mussel are documented as being approximately 20km upstream of Enniscorthy (Moorkens, 1999).

Table 7.2 Sensitive Times of the Year for Fish and Eels

Species	Month											
	J	F	M	A	M	J	J	A	S	O	N	D
Salmon (msw upstream migration)												
Salmon (1sw upstream migration)												
Salmon (smolt downstream migration)												
Sea trout (upstream migration)												
Sea trout (smolt downstream migration)												
Allis and twaite shad spawning												
Elvers (upstream migration)												
Eels (downstream migration)												

7.7 Do Nothing Scenario

Otters and their Habitat

7.7.1 There would be no change to the existing habitat used by otters, and no additional disturbance above that currently experienced (i.e. current angling, agricultural and riverside activities).

7.7.2 Potential changes could arise as a result of climate change, particularly indirect effects where the hydrology of the river would alter (reduced flows in summer and increased flows in winter), and the response of flora and fauna to this. On the whole, it is not anticipated that a clearly significant effect would occur on otters as it is unlikely that a collapse in the river ecosystem would occur and subsequently affect otters. Whether effects on water quality would arise cannot be currently determined, though if deterioration in water quality arose, changes could occur on riverine fauna and consequently on otter.

Badgers and their Habitat

7.7.3 There would be no change to the existing habitat used by badgers, and no additional disturbance envisaged above that currently experienced within the study area.

Bats

7.7.4 There would be no works or additional activities in the area of known or potential bat roosts above that currently experienced within the study area.

Fish and their Habitat

7.7.5 There would be no change to the existing aquatic habitat, and no additional disturbance above that currently experienced (i.e. angling, navigation and agricultural activity) within the study area.

7.7.6 The potential effects of climate change on the hydrology of the river could be significant for some species of fish, in particular the migratory species. This does not take into account the possible impacts on water quality, which would also have a significant impact on fish species, namely lamprey, salmon and trout. The key change that could occur is to hydrology, and with the species that are sensitive to flows and depths and presence or absence of in-river obstructions, the changes in the very long term could result in significant reductions in their populations.

Birds and their Habitat

7.7.7 There would be no change to the existing habitat used by birds, and no additional disturbance envisaged above that currently experienced, therefore, **no impact** would occur.

Freshwater Pearl Mussel

7.7.8 The nearest populations of freshwater pearl mussel are documented as being approximately 20km upstream of Enniscorthy (Moorkens, 1999). As such there would be no additional disturbance above that currently experienced within the study area, and **no impact** is anticipated.

7.8 Potential Environmental Impacts during Construction

IMPACT: Disturbance to Qualifying Features of Slaney Valley cSAC

7.8.1 Impacts to the qualifying features of the Slaney Valley cSAC are determined in the Appropriate Assessment (see **Appendix 5** for further details). A summary of the findings of the Appropriate Assessment are presented in **Table 7.3** below. Where relevant, individual impact assessments are presented for the various species in the following paragraphs.

Table 7.3 Summary of Appropriate Assessment

Feature	Impact
Migratory fish features (*Salmo salar, Alosa fallax, Alosa alosa, Petromyzon marinus, Lampetra fluviatilis, Lampetra planeri*)	Short-term minor negative impact resulting from construction activities.
Otter (*Lutra lutra*)	Short-term reversible negligible impact through disturbance to two holts and disruption to foraging access.
Floating vegetation	Short-term reversible negligible impact arising from re-suspension of sediments during construction and no impact during operation.
Old sessile oak woodlands	No impact.

IMPACT: Disturbance to Otters and their Habitat during Construction

7.8.2 Otter signs were identified in the grassland area north of the town (Grid Reference 298400 141200), and the 2005 Mammal Survey (**Appendix 10**) identified an otter holt on the grassland to the north west of the Rail Bridge, and two on a tributary of the River Slaney adjacent to the hospital. Potential disturbance could occur to otter from the widening works upstream of Enniscorthy, and the creation of the Diversion Channel. The whole construction period is anticipated to last for up to three years, with the river widening works taking at most around twelve 12 months.

7.8.3 Permanent flood defences would be built alongside the river through Enniscorthy and the river would be widened on the east and west bank of the River Slaney upstream of the railway line and Railway Bridge (see **Figure 3.12**). The river widening works north of the Rail Bridge would not result in any direct impacts to the otter holt. There is the potential for disturbance from construction activities and activities which may result in otter avoiding the holt for the duration of the construction period.

7.8.4 The widening works are surrounded by infrastructure, with the railway and roads nearby; however, there is little other human activity. Consequently, the frequency of otter feeding or any other activities in this area is likely to be low to medium. The works would take place a section at a time, thereby resulting in only a localised area of disturbance. The likelihood of it causing disturbance sufficient to cause otters to move out of the area is considered to be low, due to the existing levels of human activity along the riverside areas, and the nature and timing of the construction works. No direct disturbance is expected to occur on these holts.

7.8.5 A 1.25km flood alleviation channel would be created downstream of Enniscorthy (see **Figure 3.4**). In addition, a 210m road bridge will be constructed at this location. The timescale for the works is not yet known, it is anticipated that the channel will be excavated and then connected to the main river. The connections will be made during the period May-October. The channel will be excavated by JCB with lorries moving arisings along the river or to the flow deflectors in the meadows to the north of the Railway Bridge. The works for the new channel and new bridge will not result in direct disturbance to the two otter holts.

7.8.6 The area is not currently subject to high levels of activity as it is not accessible to vehicles or pedestrians. As a result the frequency of otter feeding or other activities in this area is likely to be medium to high. The likelihood of the works causing disturbance sufficient to cause otters to move out of the area is considered to be medium due to the current lack of disturbance at this location. Disturbance to active breeding holts (when present within c.150m of a scheme) falls within Section 25 of 1997 Habitats Regulations and must be undertaken under license. The National Parks and Wildlife Service (NPWS), of the Department of the Environment, Heritage and Local Government is responsible for processing these licences.

7.8.7 Overall, using the criteria in **Table 4.6**, the receptors are highly sensitive in relation to the destruction of an otter holt, and the magnitude is medium in level when incorporating the feeding and other areas of disturbance. Consequently, a potential **major negative impact** could occur.

Mitigation Measures

7.8.8 Mitigation measures must be undertaken to offset the disturbance of otters, particularly adjacent to the flood alleviation channel. It is recommended that two artificial holts are created to provide alternative habitat for use during periods of high disturbance. They should be located as near to the existing holts as possible, though as a further mitigation it may be suitable to construction another artificial holt further upstream and away from areas of disturbance. The design and location of the artificial holts should be agreed with the NPWS and be available for use by otter before the construction period commences.

7.8.9 In addition, the following mitigation measures must be implemented prior to construction:

- No works should be undertaken within 150m of any holts at which breeding females or cubs are present. Following consultation with NPWS, works closer to such breeding holts may take place, provided appropriate mitigation measures are in place (e.g. screening and/or restricted working hours on site);
- No wheeled or tracked vehicles (of any kind) should be used within 20m of active, but non-breeding, otter holts. Light work, such as digging by hand or scrub clearance should also not take place within 15m of such holts, except under licence;

- The prohibited working area associated with otter holts should, where appropriate, be fenced with temporary fencing prior to any possibly invasive works. Fencing should be in accordance with Clause 303 of the NRA's Specification for Roadworks. Appropriate awareness of the purpose of the enclosure should be conveyed through notification to site staff and sufficient signage should be placed on each exclusion fence;
- All contractors or operators on site should be made fully aware of the procedures pertaining to each affected holt;
- Where holts are present in close proximity to invasive construction works but are determined not to require destruction, construction works may commence once recommended alternative mitigation measures to address otters have been complied with; and
- River widening works should be undertaken one bank at a time to ensure foraging access at all times during the construction period.

Residual Impact

7.8.10 Provided the measures are carried out successfully the holt(s) are likely to be re-populated and used, and as such a short-term **negligible residual impact** would be expected.

IMPACT: Disturbance to Badgers and their Habitat during Construction

7.8.11 No badger activity was recorded in the area of the proposed works during the Phase I Habitat Survey in 2003 and the Mammal Survey in 2005. Consequently, **no impact** is anticipated upon badger populations.

IMPACT: Disturbance to Bat Roosts during Construction

7.8.12 During the July 2003 Habitat Survey, a number of buildings near the mouth of the Urrin (approximately 1km downstream of Enniscorthy) were identified with the potential to support bats. River widening and re-grading works are scheduled for the stretch of River Slaney nearby (approximately 250m from these buildings). The works themselves will not directly affect these buildings. In addition, the 2005 Mammal Survey identified bat roosts within the area, none of which occur in structures which require demolition for the scheme. Given that no roosts will be directly affected by the works, **no impact** is predicted.

IMPACT: Disturbance to Bat Foraging Habitat during Construction

7.8.13 The 2005 Mammal Survey identified Daubenton's bat (*Myotis daubentoni*); Soprano pipistrelle (*Pipistrellus pygmaeus*); Common pipistrelle (*P. pipistrellus*) and Leisler's bat (*Nyctalus leisleri*) foraging in the river corridor. These are all afforded protection under Annex IV of the EU Habitats Directive.

7.8.14 The removal of riverside vegetation to enable the river widening upstream of Enniscorthy will interfere with feeding areas for bats such as the pipistrelle species and Daubenton's bats. Bats in general seek sheltered relatively dark sites within which to feed or to commute to and from roosts. Changes in the level of vegetation cover will decrease the amount of shelter and decrease insect abundance.

7.8.15 The river widening works are anticipated to last for around twelve months. During this time there will be a reduction in suitable foraging habitat for bats. Alternative foraging habitat for bats will remain on the drains and tributaries which feed into the River Slaney. Given the conservation status of these species the sensitivity of the receptor must be considered

very high, the magnitude of the effect may be low due to the limited amount of scrub that would be cleared. Consequently, a potential **moderate negative impact** may be expected.

7.8.16 On completion of the works the neutral grassland vegetation will be reinstated. Over time shrub habitat will re-establish which will provide shelter and foraging habitat for bats. The impact to bats will be reduced to **no impact** over time.

IMPACT: Disturbance to Fish and their Habitat during Construction

7.8.17 The stretch of the River Slaney likely to be affected by construction activity supports a number of species listed in Annex II of the EU Habitats Directive, namely: Atlantic salmon, twaite shad, allis shad, and lamprey (sea, river and brook). However, the preferred spawning grounds are believed to be further upstream (ERFB, *pers. comm*, July 2003). In-river works will be required from approximately 400m downstream of the Seamus Rafter Bridge to 1.25km upstream of the Railway Bridge. Works will also include underpinning the Enniscorthy Bridge and to the Railway Bridge.

7.8.18 The river works could effect the spawning grounds of the aforementioned species, both through direct loss of habitat, and the mobilisation and deposition of river silts that may clog up spawning gravels further downstream. Given the conservation status of these species the sensitivity of the receptor must be considered very high, however the magnitude of the effect would be low due to the localised and small-scale nature of the in-river works, and the limited volume of silt within the in-river bed sediments. Consequently, a potential **moderate negative impact** is anticipated.

Mitigation Measures and Residual Impact

7.8.19 However, provided the Eastern Regional Fisheries Board "in-river works closed season" is adhered to (October to April), and measures described in **paragraph 9.8.5** are implemented, the magnitude and likelihood of this impact occurring will be significantly reduced to low; therefore a potential **minor negative residual impact** would be anticipated in the short-term (i.e. for the one summer duration of the river works). Particular determination of the date and appropriate mitigation measures will also entail ensuring lamprey larvae would not be affected.

IMPACT: Disturbance to Birds and their Habitat during Construction

7.8.20 During the July 2003 Habitat Survey, an area of bank habitat north of Enniscorthy town (approximate Grid Reference 297300 140500) was identified as important for kingfishers and in particular sand martins. Both sand martins and kingfishers are listed on Birdwatch Irelands amber list (medium conservation concern). A colony of sand martins (approximately 12 active nests) was seen nesting in the left bank (east bank) at this point and kingfishers were observed using the channel at this point for feeding.

7.8.21 The proposed works include deepening and widening of the river in this region and would result in the total loss of this sandbank. Given the conservation status of these species the sensitivity of the nests must be considered of national importance, though the magnitude is considered to be low as no direct disturbance would occur other than through possible noise disruption. Therefore, a potential **moderate negative impact** is predicted.

Mitigation Measures and Residual Impact

7.8.22 Due to fisheries constraints it is not possible to time construction to avoid the breeding bird period (March to September). In order to reduce impacts to breeding birds it will be necessary to make the sandbank unsuitable for sand martin before the breeding bird period (i.e. between October and February). This will result in the loss of breeding habitat for the duration of the construction period (anticipated to be twelve months). The new river banks should be designed to provide at least the same area of sand bank, if not more, on completion of the works for colonisation by sand martin and kingfisher. This would result in a **short term moderate negative impact** for the duration of the works which will reduce to no residual impact on completion of the works provided the mitigation is successful.

7.8.23 Sand martin and kingfisher were also observed foraging in the proposed location of the flood alleviation channel and new bridge. Works at this location would result in the reduction of suitable foraging habitat for the duration of the construction period. Alternative foraging habitat for birds will remain on the drains and tributaries which feed into the River Slaney. Given the conservation status of these species the sensitivity of the receptor must be considered very high, the magnitude of the effect may be low to medium dependent upon the amount of vegetation that is cleared. Consequently, a **short term moderate negative impact** will occur for the duration of the works which will reduce to **no residual impact** on completion of the works.

IMPACT: Disturbance to Freshwater Pearl Mussel during Construction

7.8.24 The nearest populations of freshwater pearl mussel are documented as being approximately 20km upstream of Enniscorthy (Moorkens, 1999). As such there will be **no impact** upon freshwater pearl mussel populations as a result of this option.

IMPACT: Sediment Re-suspension and Effects on Aquatic Fauna during Construction

7.8.25 River widening and dredging, and possibly works to raise floodwalls adjacent to the river, could result in the re-suspension of silt and soil into the river. Significant increases in water turbidity for long periods of time are likely to cause adverse effects on many aquatic organisms through reduced light attenuation through the water column, re-suspended silts and sediments could also increase the biological oxygen demand (BOD) or chemical oxygen demand (COD), resulting in reduced dissolved oxygen levels. In addition, increased suspended sediment can also cause stress and affect the gills of fish, as well as cover important spawning gravels; depending on the location of the re-suspension, the extent of re-suspension, the river flows at the time of re-suspension, and existing levels of suspended sediment. However, the preferred spawning grounds are believed to be further upstream of the works area (ERFB *pers comm*, July 2003) and are therefore unlikely to be affected by re-suspension and deposition of sediment.

7.8.26 Given that the effect would be felt by a wide range of species, in addition to the presence of designated species, the sensitivity of the receptor is considered to be high. However, the magnitude of the effect is considered to be low, due to the nature of the river bed sediments and localised nature of the works (see **paragraphs 9.8.4** and **9.8.5**), and given that the widening works would take place when river levels are low. Consequently, a **moderate negative impact** would be expected.

Mitigation Measures and Residual Impact

7.8.27 Provided the Eastern Regional Fisheries Board "in-river works close season" is adhered to (November to April) and measures described in **paragraph 9.8.6** are implemented, the magnitude and likelihood of this impact occurring will be significantly reduced; therefore, a potential **minor negative residual impact** would be anticipated in the short-term (i.e. for the one summer duration of the river works).

IMPACT: Contaminant Mobilisation and Effects on Aquatic Fauna during Construction

7.8.28 Given the minor risk of potential contaminants (see **paragraphs 8.8.2** to **8.8.5**), and the unlikely transport and magnitude of re-suspension (see **paragraphs 9.8.8** and **9.8.9**), the potential negative effects to the health of faunal species of all kinds within the river is low. However, given the conservation status of the species present in the river the sensitivity of the receptor is considered to be very high. Consequently, a potential **moderate negative impact** could occur.

Mitigation Measures and Residual Impact

7.8.29 Provided the mitigation measures identified in **paragraphs 8.8.6** and **9.8.6**, the potential volume of sediments re-suspended would be reduced, and the possibility of contaminated sediment being discharged to the watercourse would also be reduced, such that a potential short-term **negligible residual impact** would remain.

IMPACT: Accidental Spillages during Construction

7.8.30 The construction process poses a potential pollution risk to the existing flora and fauna in the area of the works. Any accidental spillage of construction materials such as concrete and cement or leakages from construction plant such as fuel oil, could affect the communities and species present.

7.8.31 The significance of any pollution event occurring from an accidental spillage of construction materials would be dependent on the materials involved and the scale of the spillage.

7.8.32 However, providing that pollution prevention guidelines are adhered to, any risk of accidental spillages would be minimised, so **no impact** is expected.

7.9 Potential Environmental Impacts during Operation

IMPACT: Disturbance to Otters and their Habitat during Operation

7.9.1 The proposed scheme reduces water levels through the town (generally between 0.5 and 1m) and in the 1.5km stretch upstream of the town (alongside Island Street) this benefit increases to 1.25m. Consequently, there would be a reduced risk of inundation of otter holts within the study area.

7.9.2 The provision of artificial otter holts identified in **paragraph 7.8.5** above, should ensure that there is no loss in the medium- to long-term. Overall, therefore, a **minor positive impact** is anticipated, though this could increase in scale if additional otter holts were provided.

IMPACT: Enhancement of Otter Habitat

7.9.3 The widening of the river within Enniscorthy and both upstream and downstream, coupled with the creation of a shallow berm and remedial measures (such as planting of aquatic and soft riverbank plants) would result in additional habitat for otters, particularly in the downstream reach as there is already an indication of potential otter habitat. The

additional habitat is considered to be of local/low value in the regional context, but medium in magnitude as approximately >40ha of additional river and riparian habitat would be created. In addition, the creation of two additional otter holts will provide enhanced breeding sites within the river system. Consequently, a potential **minor to moderate positive impact** is anticipated.

IMPACT: Disturbance to Badgers and their Habitat during Operation

7.9.4 Badger activity was recorded in the floodplain upstream of the Rail Bridge during the 2005 mammal survey. As there would be no increase in the floodplain in this area, and potentially a decrease, **no impact** is anticipated on badger populations.

IMPACT: Disturbance to Fish and their Habitat during Operation

7.9.5 River widening in the downstream 400m and upstream 1.5km stretches of river at the Seamus Rafter Bridge will convert areas of existing floodplain to a new berm area of aquatic habitat. Medium to high flows with various combinations of tidal influence will flood out onto this berm. Remedial measures will include the planting of appropriate soft vegetation. As such, this represents a potential improvement to the fauna aspect of the cSAC designation as the incorporation of berms throughout this length could increase habitat diversity. Therefore, a **minor positive impact** could arise.

7.9.6 Floods can produce dramatic erosion and accretion on the River Slaney. As the range of extreme flow velocities along the river affected by the proposed scheme will reduce, the geomorphology will be more stable than at-present. This should maintain the beneficial in-stream habitat for fish, which is at a high sensitivity and medium magnitude as it would take place upstream and downstream of Enniscorthy.

7.9.7 The action of re-grading the riverbed under both the Railway Bridge and Enniscorthy Bridge will in fact remove the existing obstacles to upstream migration and may facilitate fish movement in these areas. Fish are currently held in pools downstream of these obstructions until water levels are high enough to progress further upstream. Consequently greater numbers of returning fish will be able to reach the spawning grounds further upstream (and this could also have knock-on beneficial effects for otters, etc.) and so a **minor to moderate positive impact** to fish is expected as a result of the scheme.

IMPACT: Disturbance to Birds and their Habitat during Operation

7.9.8 The known sand martin nesting area is approximately 150m beyond the upstream extent of the scheme so **no impact** is anticipated during the operation of the scheme.

7.10 Monitoring

7.10.1 As noted in **Section 5.10** there is a requirement to maintain monitoring of recreational angling for three years after construction. There is, overall, a requirement for the OPW (in collaboration with ERFB) to utilise the monitoring of migratory and spawning fish (particularly salmon, shad, and lamprey) within the study area to ensure that the long term improvements anticipated from the scheme are occurring. It is expected that monitoring would occur for three years after completion of the scheme, and each year a discussion of the results would be undertaken with NPWS and ERFB.

8 SOILS (AND GEOLOGY)

8.1 Introduction

8.1.1 This section examines the geological, geomorphological and sediment attributes for the study area, and the potential effects of the proposed scheme on them during construction and operation.

8.2 Assessment Methodology

8.2.1 There is no specific assessment methodology relative to the attributes under this heading and, consequently, the methodology for the assessment of significance is that described in **Section 4.6**.

8.3 Data Collection

8.3.1 The data collected for this EIS principally comprised:

- Irish Geological Survey Data;
- Historic borehole data (covering the garage along Promenade Road, the line of the Seamus Rafter Bridge, along Abbey Quayside, and work undertaken at the Leisure Centre); and
- A geomorphological study undertaken on behalf of the OPW (Jacobs, 2008).

8.4 Surveys

8.4.1 A walkover survey was undertaken in relation to the geomorphological study identified in **paragraph 8.3.1**. No other specific surveys were undertaken.

8.5 Consultation

8.5.1 Consultation was undertaken with the Environmental Protection Agency with respect to likely sediment sampling requirements.

8.6 Baseline Environment

Solid Geology

8.6.1 The Irish Geological Survey map for Carlow-Wexford (Sheet 19) shows that the geology of the area around Enniscorthy generally comprises rocks of Lower Palaeozoic age, dating from the Ordovician period between 525 million and 440 million years ago. There is one site, at Greenville townland that has been recommended for designation as a Natural Heritage Area (NHA) on account of its potential value as a source of Precambrian to Devonian age palaeontology. The site lies 1km north of Enniscorthy (Grid Reference 296300 141400; also refer to **Figure 6.3**).

Fluvial Geomorphology

8.6.2 The River Slaney from Scarrawalsh to the Boro River is a low to moderate energy river system as a consequence of its low to intermediate slopes and a fairly straight planform. The river's confinement (i.e. closeness of the valley sides) means that it will have enhanced energy during floods, thereby giving the river a moderate capacity to entrain sediment. The river channel has not measurably altered its planform since the mid-19th century (Jacobs, 2008), despite major floods in recent history, suggesting that this is a relatively inactive channel. However, as historic water levels, depths of water and depths of sediment are not known, the earlier (pre-19th Century) planform of the river cannot be discerned. In-channel features (e.g. mid-channel islands/bars) possibly allude to an earlier, more braided (or anabranching) planform (Jacobs, 2008). However, many of these geomorphological features appear to have been lost over time as the river channel has adjusted in response to lower discharges.

8.6.3 The present river bed comprises mobile sands and gravels, with some fine material (clays and silts). Evidence from the upstream catchment reveals a legacy of glacial sediments (Jacobs, 2008). However, there are few 'fining up sequences' in the bank sediments, again indicating relative inactivity. Typically, the river banks surveyed were found to be relatively uncohesive sands with little clay content (probably inherited from glacial material). This suggests a channel with a low threshold for erosion (Jacobs, 2008).

8.6.4 A number of side bars, generally comprising fine material (predominantly sand), are recorded upstream of Enniscorthy itself. These indicate that the channel is narrowing (Jacobs, 2008). However, the volume of deposition is fairly insignificant compared to the size of the channel (Jacobs, 2008). Downstream of the bridges through Enniscorthy deposition has occurred in the form of berms. These berms indicate narrowing where the river is re-adjusting to a more natural width in these locations (possibly as a result of previous over-widening by human influence). Sand bars have also appeared in the reach alongside the Riverside Park Hotel where the river widens and flow reduces, allowing fine sands to deposit at this location.

8.6.5 In terms of sediment transport, the results of the geomorphological study indicate that the surveyed reaches are approximately 50% sink, 40% transfer and 10% source (though deposition is believed to be insignificant compared to the channel size). This means that relative to actively meandering channels the re-working of sediment does not take place along the River Slaney upstream, through and downstream of Enniscorthy. Rather, the river acts as a conveyor belt within the confines of its own channel, transferring sediment through the town (Jacobs, 2008). The deposition that does occur is typically fine material (including sands) that is likely to be sourced from the wider catchment (i.e. agricultural practice rather than colluvial or bank erosion sources). In terms of sediment transport volume, this river is therefore judged to be of low to moderate risk (Jacobs, 2008).

Sediments

8.6.6 No sediment quality data is held for the aquatic sediments within the River Slaney in the area of Enniscorthy. No survey was undertaken to inform the EIA process due to the lack of detailed design available at this stage, for example, in determining which sediments are to be removed, reused during the works, or sent for disposal. The sediments within the river include gravels, sands and some silt. Borehole records on the quaysides indicate layers of sandy silt, and silty clay and cobbles present at depths of greater than 1.4m below ground level (this is usually the depth of made ground and concrete within the boreholes and trial pits examined).

8.6.7 The sediments within the river are and have been transported along the river and due to the river's low threshold for erosion the majority of sediments are anticipated to be larger particulates (sands and gravels with limited fines). However, limited borehole data indicates a shallow layer of finer material overlying coarser materials. Deposited sediments (silt) and the potential pollutants they contain are dependent on the run-off and source of deposition of the sediments. Within the catchment of the study area there is very little significant industry situated along the River Slaney both upstream and downstream of Enniscorthy, or along its tributaries. Grassland (pasture and grazing land) dominates the catchment, with some horticulture also covering a sizeable area of land within the catchment. Further upstream some small areas of arable farming are also present, which could result in run-off of fine sediments into the river.

8.7 Do Nothing Scenario

Fluvial Geomorphology

8.7.1 The existing hydrological regime would not change as accretion and erosion patterns would not be altered due to the low to moderate energy state of the river. Localised geomorphological features in the river could change as a result of high energy fluvial events where flooding results in the transfer of large volumes of sediments over short time periods.

Drainage

8.7.2 Existing hydrology and drainage patterns would not change.

Geological Deposits

8.7.3 Solid geological deposits would not be disturbed.

8.8 Potential Environmental Impacts during Construction

IMPACT: Disturbance to Geological Deposits during Construction

8.8.1 There are no geological exposures within the area of the proposed construction works. Consequently, **no impact** is expected.

IMPACT: Disturbance or Mobilisation of Potentially Contaminated Sediments during Construction

8.8.2 The widening of the river and dredging of lengths of the riverbed could result in the disturbance and mobilisation of potentially contaminated sediment into the water column followed by dispersion and deposition downstream. Contaminated sediment could directly affect the quality of the receiving environment if it significantly more contaminated than the riverbed sediment on which it is deposited).

8.8.3 In addition, the mobilisation of contaminated sediment into the water column could indirectly cause significant negative effects on water quality and the health of faunal species within the river that are exposed to it. Given the conservation status of the species present in the river, the sensitivity of this indirect impact receptor is considered to be very high. The magnitude of an indirect effect is considered to be medium as there are extensive excavation and dredging works along the river both within and outside the town.

8.8.4 However, the likelihood of the effect occurring is anticipated to be low due to the pre-dominance of sands and gravel in the river bed deposits. Compared to fine-grained sediments such as clays and silts, the dominant sediment types in the River Slaney have a

relatively low potential to concentrate significant weights of contaminants due to the limited availability (both physically and chemically) of contaminant binding sites on these sediments' surfaces. Furthermore, the river's catchment contains little industry that would form a source of contaminants. Therefore, the main sources of contaminants are largely limited to road run-off, which could contribute contaminants associated with fuel and oil, and agriculture, which could contribute contaminants associated with chemicals used in fertilisers and pesticides.

8.8.5 Furthermore, the likelihood of an impact is restricted by the construction method. The river widening works would take place during low to medium water flows, and as such much of the material removal would take place out of water, and thus limit the mobilisation of sediments within the river. Overall, a potential **minor negative impact** could occur.

Mitigation Measures

8.8.6 A sediment quality survey could be undertaken to identify potentially contaminated land and riverbed deposits (albeit targeted at fine-grained sediments such as silts and fine sands) during detailed design and prior to construction. This could help identify appropriate mitigation measures to be employed during construction and for waste management requirements to be identified. This would ensure that a significantly reduced volume of potentially contaminated sediment enters the watercourse, for example by resulting in the specification of particular equipment to extract the material avoiding high rates of losses of material into the watercourse, and also to identify relevant protective clothing requirements. To manage this process, a material management strategy should be produced and developed in consultation with the EPA and Wexford County Council, in order to identify appropriate reuse, recycling recovery or disposal of any material (and it's quality) in an appropriate and licensed manner, and this would include the detailed measures to avoid the re-mobilisation of any contaminants into the water environment. Consequently, following the development of the material management strategy to the requirements of the EPA, a potential short-term **negligible residual impact** would be expected.

8.8.7 The use of river bed or river widening material for the flow deflectors on the meadows upstream of the Railway Bridge may require a licence under the Waste Management Act 1996. The licence would need to be sought from the EPA for both disposal to land, as well as the discharge of water from bed and river widening material. However, if material can be shown to be reusable or recyclable (e.g. sand and gravel extracted for aggregate use) no permission would be required. In addition, if material can be used for 'beneficial' purposes (e.g. raising land to enhance drainage) a licence would not be required. These details will be clarified and confirmed with the EPA during the detail design stage.

8.9 Potential Environmental Impacts during Operation

IMPACT: Changes to Fluvial Geomorphology

8.9.1 River widening will create a new berm. Low flows with various combinations of tidal influence would remain within the present-day river so water depth and velocity should not significantly change from present-day. Medium to high flows, however, with various combinations of tidal influence will flood out onto this berm thereby providing an area alternatively exposed or under water. The range of extreme flow velocities will, therefore, be lower than experienced at present so sediment erosion, transportation and deposition will not significantly change. In addition, the creation of the sediment trap at the upstream end of the scheme area (to the north of the meadows) would serve to prevent any changes occurring to sediment deposition in the reaches within Enniscorthy. Furthermore, the

creation of a low flow channel though Enniscorthy as part of the river bed regarding work would also maintain the low to moderate energy environment of the River. Overall, there would be no significant alteration to the geomorphological processes and **no impact** expected.

IMPACT: Disturbance to Geological Deposits during Operation

8.9.2 There are no geological exposures within the area of the river that would experience erosion or accretion. Consequently, **no impact** is expected.

8.10 Monitoring

8.10.1 No monitoring requirements are expected following completion of construction.

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9 WATER

9.1 Introduction

9.1.1 This section examines the attributes relating to water, including hydrology, water quality and water quantity where relevant, and the potential effects of the proposed scheme on them during construction and operation.

9.2 Assessment Methodology

9.2.1 There is no specific assessment methodology relative to the attributes under this heading, consequently, the methodology for the assessment of significance is that described in **Section 4.6**.

9.3 Data Collection

9.3.1 The data collected for this EIS was principally water quality data from the Environmental Protection Agency, as well as abstraction and discharge information from Wexford County Council.

9.4 Surveys

9.4.1 No specific surveys were undertaken for these attributes.

9.5 Consultation

9.5.1 No specific consultation was undertaken with respect to water.

9.6 Baseline Environment

Hydrology

9.6.1 The Rivers Boro, Urrin and Bann are the principal tributaries of the River Slaney in relation to the study area. The River Urrin and River Boro both drain the eastern flanks of the Blackstairs Mountains (approximately 18km west of Enniscorthy) and discharge into the River Slaney 1km and 4km downstream of Enniscorthy respectively. The catchment of the River Slaney upstream of Scarrawalsh is 1036km^2, and is 1277km^2 at Enniscorthy (which includes the addition of the Bann catchment). The River Bann drains an area north of Enniscorthy and discharges into the River Slaney 6km north of Enniscorthy.

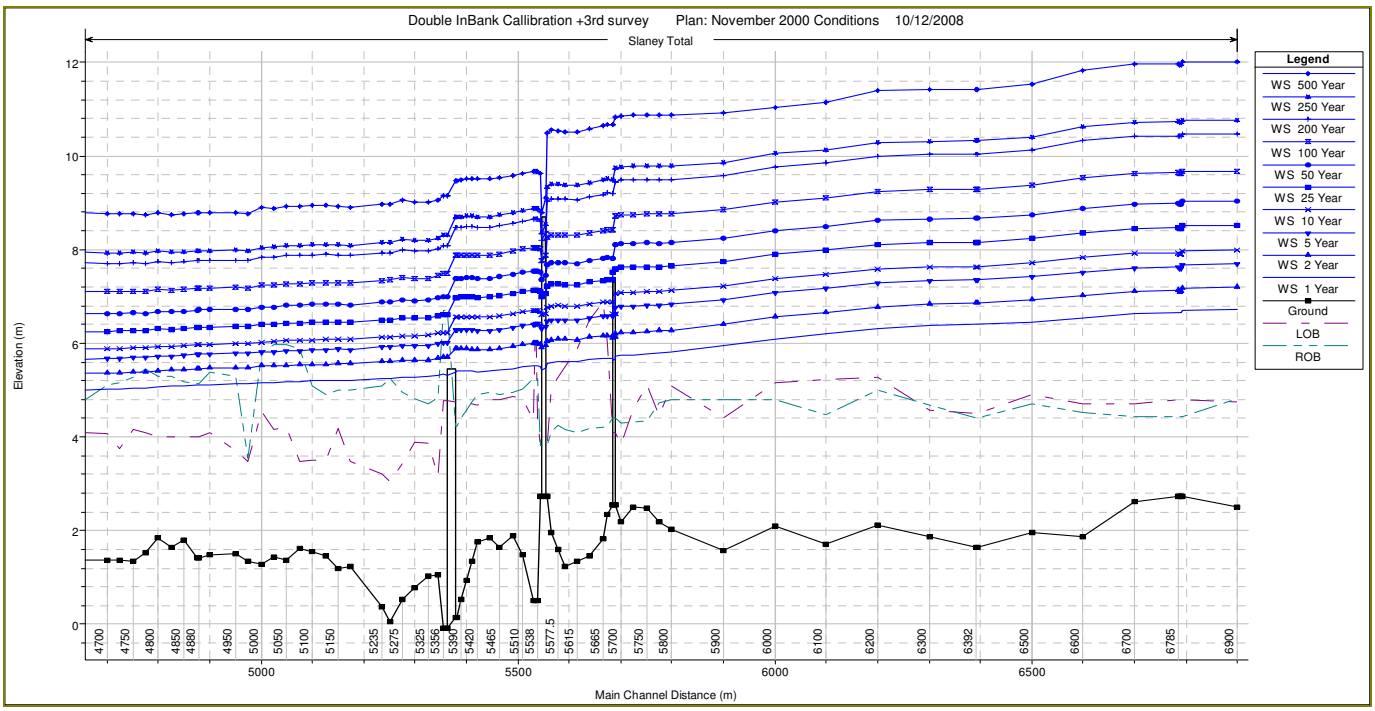
9.6.2 The River Slaney is tidal to Enniscorthy, with the tidal and freshwater boundary defined, under section 10 of the Fisheries (Consolidation) Act 1959, as the Old Bridge in Enniscorthy (ERFB, *pers. comm,* 2003). The water level record at Enniscorthy Bridge confirms that the River Slaney is tidal at Enniscorthy and that many floods are joint tidal/fluvial events. Detailed examination of the record of 250 fluvial and/or tidal events, carried out by OPW, found tidal influences in the flow record up to 6.2m above OD (Poolbeg). As the flood water levels increase, the hydrograph record shows that the tidal effect gets smaller, and became almost unnoticeable, at levels approaching 6.2m above OD (Poolbeg). Consequently, the effect of the tide at Enniscorthy does have a definite upper limit and that this is less than 6.2m above OD. By comparison, extreme river floods reach levels significantly higher than this tidal limit of 6.2m above OD; the November 2000 event reached 7.55m above OD (Poolbeg) and the November 1965 flood reached 8.87m above OD (Poolbeg).

9.6.3 The peak flow of the 100-Year hydrograph at Enniscorthy, calculated using the 'rainfall-run-off' technique, is 498m^3/s. The 1965 peak flood flow is estimated at 388m^3/s, and the November 2000 peak flood flow is estimated to be 287m^3/s. **Table 9.1** presents the return period flows for 1 to 500 year events, and **Figure 9.1** presents the water level estimates of the return period flood flows.

Table 9.1 Return Period Flood Flows on the River Slaney at Enniscorthy

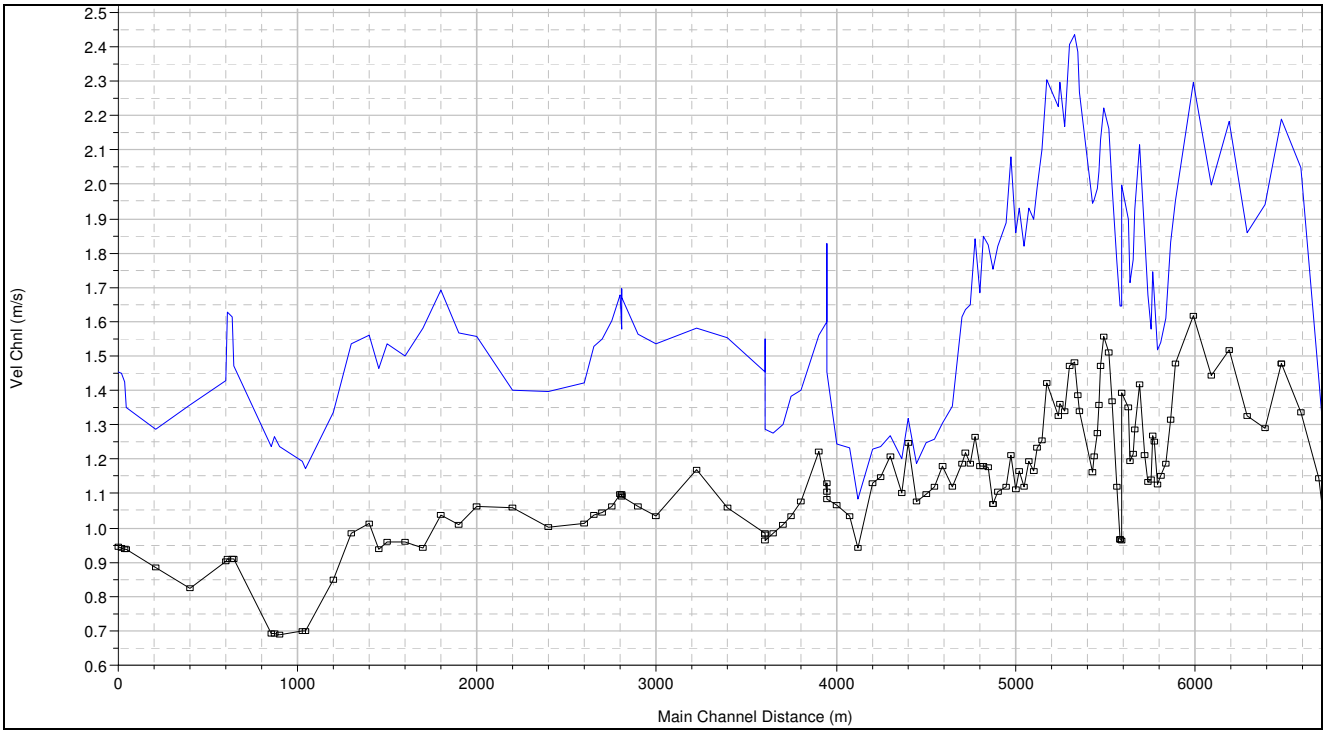
Return Period	Estimated Peak Flows at Enniscorthy
(Years)	(m^3/s)
1	175
2	216
5	258
10	288
25	346
50	409
100	**494**
200	610
250	656
500	832

Figure 9.1 Estimates of Return Period Water Level Profiles through Enniscorthy



9.6.4 The OPW engineering study confirmed that the River Slaney erodes, transports and deposits sediments and that these sediments contain gravels. At both the upstream extent of the study area (1.2 km upstream of the Railway Bridge) and immediately downstream of the town flow velocities are lower than through it, as shown on **Figure 9.2**, and as a result deposition occurs in these areas. A large river island has formed in the upstream area and the river survey shows that bed levels are also high while, in the downstream area, two large sand bars have formed downstream of the Riverside Park Hotel and the play area.

Figure 9.2 Estimates of Return Period Water Level Profiles through Enniscorthy



Hydrogeology

9.6.5 The Aquifer Map of Ireland produced by the Geological Survey of Ireland classifies the slates of the Oatlands and Ballyhoge Formations, to the south east and north west of Enniscorthy as 'Poor / Minor Aquifers' which are only locally productive. However, the volcanic rocks of the Campile Formation around Enniscorthy are classified as a 'Major Aquifer'.

Water Quality

9.6.6 The water quality of the River Slaney is considered to be in satisfactory condition in reaches upstream of Tullow, which have biological quality ratings (Q values) typically around 4-5 and 5, which are classed as unpolluted. Downstream, towards Enniscorthy, there is an indication of increased ecological stress (excessive algal growths and heavy siltation) particularly in the reach immediately below Tullow and again at Kilcarry, Clohamon and Ballycarney (EPA, 2001). In these reaches, Q values recorded between 3 and 3-4 are typical (see **Tables 9.2** and **9.3** and **Figure 9.3**) which are classed as slightly to moderately polluted.

9.6.7 The micro-invertebrate biota indicated unsatisfactory conditions with slight pollution noted downstream of Clohamon Bridge and at Ballycarney Bridge. Satisfactory conditions were observed in the lower reaches at Scarawalsh Bridge; however signs of enrichment were evident here with enhanced in-stream plant and filamentous algal growth observed. Agriculture and sewage are the suspected cause (River Slaney Biological Report, 2007).

9.6.8 The River Urrin joins the Slaney 0.5km downstream of Enniscorthy. The water quality of the River Urrin is satisfactory over most of its course, as shown in **Table 9.3**.

Table 9.2 Biological Quality Ratings (Q values) for the Slaney between Bunclody and Enniscorthy (EPA, 2008)

Location	Figure 9.1 ref.	1991	1995	1998	2001	2004	2007
Clohamon Bridge (S 933 548)	A	3	3-4	-	-	-	-
1.3km d/s Clohamon Bridge (S 935 536)	B	3	3-4	3-4	3-4	4-5	3-4
Ballycarney Bridge (S 967 488)	C	3	3-4	3-4	3-4	4	3-4
Scarawalsh Bridge (S 983 451)	D	3-4	-	-	-	-	4
Just west of Salsborough Bridge (S 998 436)	E	-	3-4	4	4	4	-

Table 9.3 Biological Quality Ratings (Q values) for the Urrin at Enniscorthy (EPA, 2008)

Location	Figure 9.1 ref.	1991	1995	1998	2001	2004	2007
Verona Bridge (S 946 399)	F	5	3-4	4-5	4-5	-	-
John's Bridge (S 969 389)	G	4-5	3-4	3-4	3-4	3-4	4

9.6.9 The River Slaney downstream from the Enniscorthy Railway Bridge was designated as a sensitive area in June 2001 under the Urban Waste Water Treatment Regulations 1994, and is afforded additional water quality protection, with a requirement for tertiary treatment for waste water discharges to the estuary. Following completion of the upgrade at the Enniscorthy Waste Water Treatment Plant (anticipated in 2011) there will be an overall decrease in nutrient loads to the river, specifically resulting in a reduction in phosphate loading, which will reduce the eutrophic status of the River Slaney downstream of Enniscorthy. This will have a positive effect on aquatic life through the reduction of plant and algal growth with corresponding benefits for dissolved oxygen levels.

Abstractions and Discharges

9.6.10 There is one abstraction licence issued for this stretch of the River Slaney (Wexford County Council) and one active discharge consent (Roadstone Provinces). These are detailed in **Tables 9.4 and 9.5** and highlighted in **Figure 9.3**. Wexford County Council is also considering an application for a discharge licence for St Senan's hospital (295700 138500).

9.6.11 There is a Wastewater Treatment Plant at Saint Johns, Enniscorthy (Grid Reference 297111 138427) to treat sewage from Enniscorthy Town and surroundings, which is pumped to the site from the existing Enniscorthy Town sewage collection network. The primary discharge point is located at Saint Johns (Grid Reference 297270 138414), see **Figure 9.3**. The secondary discharge point is located at Killagoley (Grid Reference 297345 139087). Both discharge into the River Slaney.

Figure 9.3 Water Quality Sampling Points

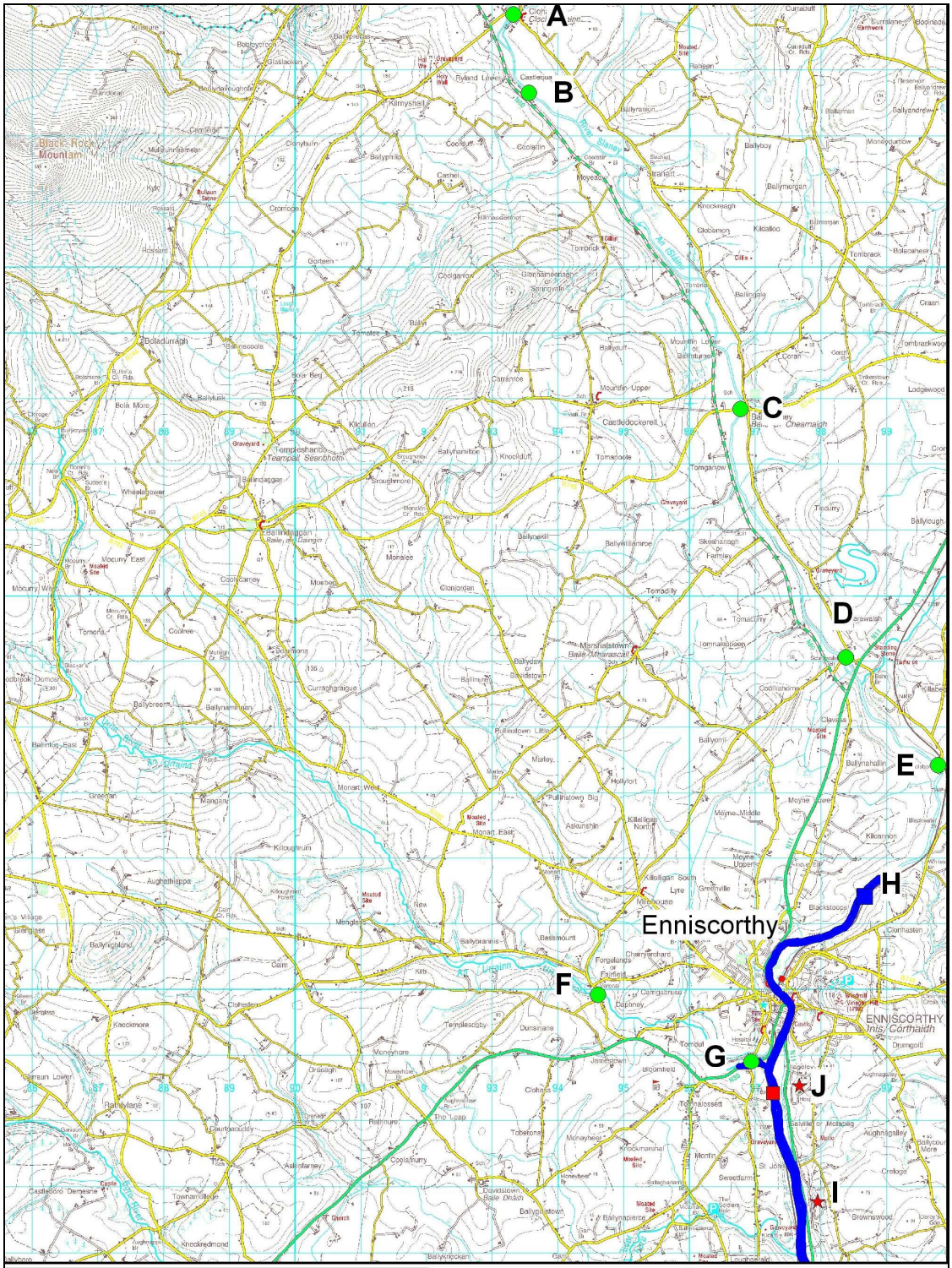


Table 9.4 Details of Known Water Abstraction Licence Holders within the Study Area

Licence holder	Figure 9.1 ref.	NGR	Details
Wexford County Council	H	Clonhasten (S 986 412)	Maximum abstraction rate – 9,090m^3/day.

Table 9.5 Details of Active Discharge Licences within the Study Area

Licence holder	Figure 9.1 ref.	NGR	Details
Roadstone Provinces Ltd	I	S 959 367	Treated effluent resulting from the washing of chippings, washing down of trucks and machines, water used to suppress dust and excess water pumped from sumps within the quarry.
St Senan's hospital	J	S 957 385	Under consideration – details unknown.

9.6.12 A scheme was drawn up for the upgrading of the entire sewage system as part of the Enniscorthy Town and Environs Development Plan 2007 – 2013 and is to be implemented in three phases. Phase 1 involves the servicing of the western environs and Blackstoops area, and these have been completed. Phase 2 involves the upgrading of the town centre, and these too have been completed. Phase 3, involved the servicing of the eastern environs and is expected to be completed by 2011.

Navigation

9.6.13 The River Slaney is navigable up to Enniscorthy and has in the past been a busy waterway. However, at low tide and during periods of low flow it is essentially non-navigable.

9.7 Do Nothing Scenario

Hydrological Regime

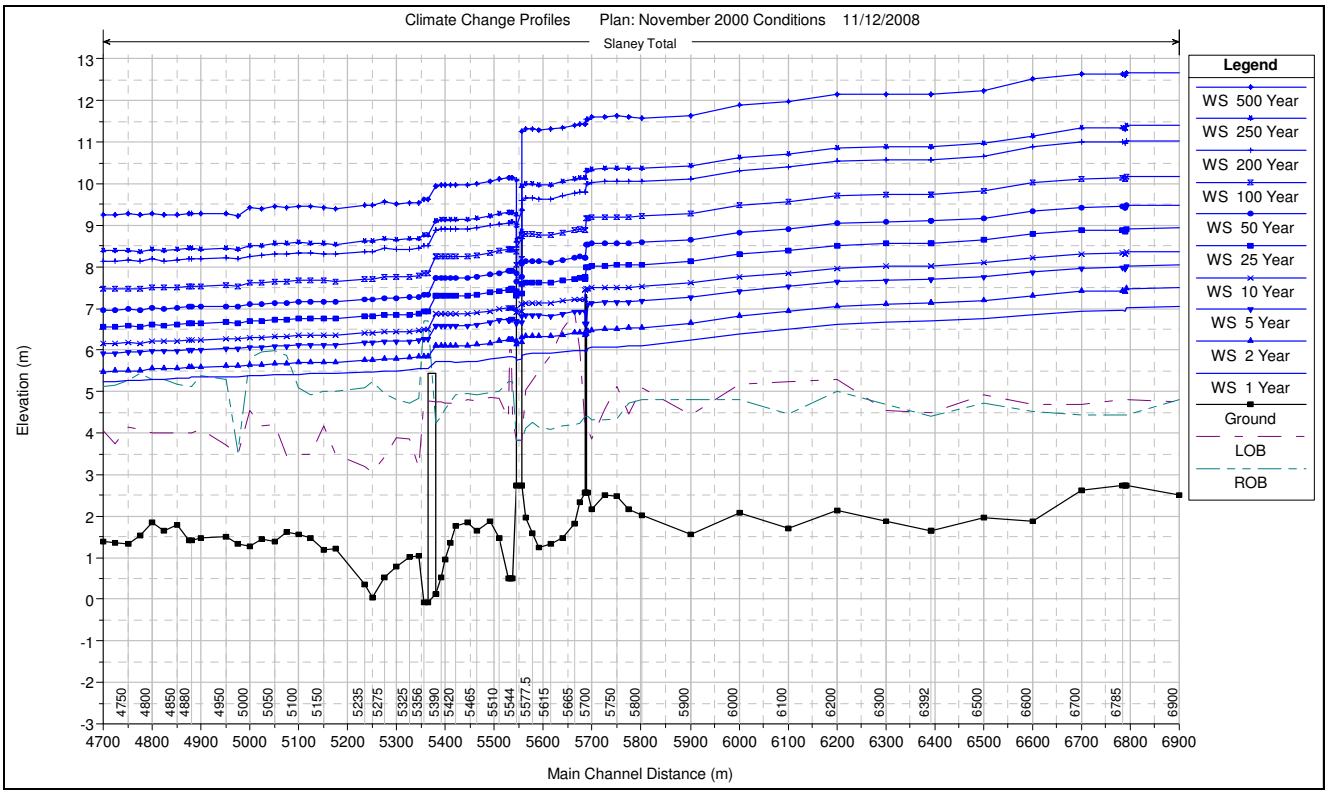
9.7.1 Natural processes will continue to change the hydrological regime. Accretion will continue upstream of Enniscorthy Bridge and the railway bridge as well as at the two sandbars at the public car park just downstream of the Riverside Park Hotel and erosion will continue (e.g. immediately downstream of the bridges). Overall, no significant changes are expected within the study area.

9.7.2 The effects of climate change on hydrology within the river are potentially significant. Reduced volumes of water within the river in summer and increased volumes in winter would alter the sediment erosion and deposition regime, and result in changes to bed levels and sediment composition throughout the river reach. **Table 9.6** presents the return period events and their flood flows based on the 2050 predictions in storm intensity for the River Slaney at Enniscorthy, whilst **Figure 9.4** presents the return period flood water levels taking into account climate change predictions in rainfall and flow. With climate change, Enniscorthy becomes at risk of serious and extreme flooding more frequently.

Table 9.6 Return Period Flood Flows at Enniscorthy taking into account Climate Change

Return Period	Estimated Peak Flows at Enniscorthy
(Years)	(m^3/s)
1	201
2	247
5	295
10	330
25	396
50	467
100	**565**
200	698
250	751
500	952

Figure 9.4 Estimates of Return Period Water Level Profiles through Enniscorthy taking into Account Climate Change

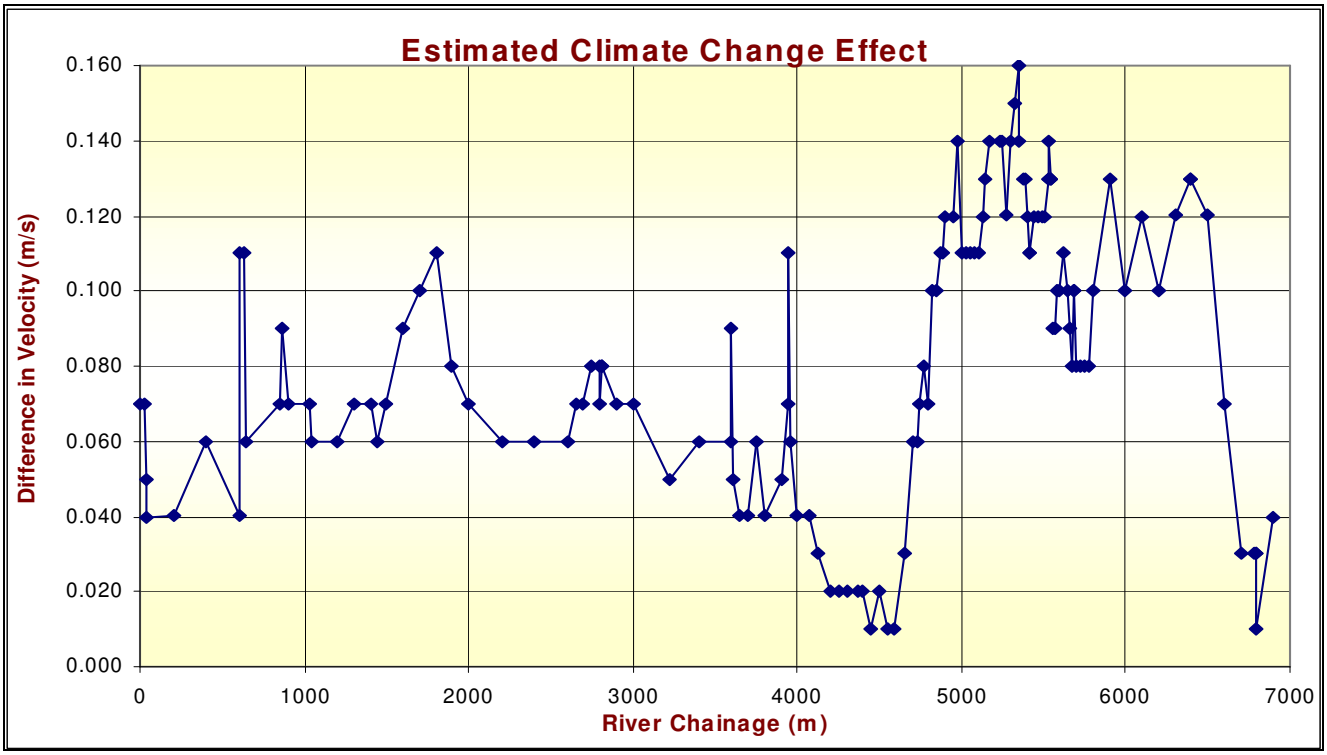


9.7.3 **Figure 9.5** presents the change in flood water velocities during the 100 Year Event, based on the flows in **Table 9.6**, as a result of the 2050 predicted climate change effects.

Suspended Sediment

9.7.4 Other than the existing rates of erosion and subsequent sediment re-suspension under the existing natural or semi-natural (i.e. constrained river) hydrological regime, there would be no change to water quality, where it relates to suspended sediments.

Figure 9.5 Estimates of Flood Velocity within a 100 Year Event taking into Account Climate Change



Abstractions/Discharges

9.7.5 The existing hydrological regime and infrequent flood events are not expected to prevent or disrupt existing abstractions and discharges.

9.8 Potential Environmental Impacts during Construction

IMPACT: Accidental Spillages during Construction

9.8.1 Construction works involve extensive in-river works including dredging and river widening. These works, as well as construction of the floodwalls close to the riverbanks, could result in spillages and leakages entering the watercourse. Spills of construction materials may include concrete and cement, and leaks from construction equipment may include fuel, oil and lubricant. Therefore, the construction process poses a potential risk (rather than an impact) to water quality in the area and further downstream. Such an incident is not a planned part of the proposed scheme, and so it can only be considered as a risk to water quality. Any accidental spillage of construction materials could affect water quality and, indirectly, the species present in the river.

9.8.2 The significance of a pollution event due to an accidental spillage of construction materials is dependent on the materials involved, the scale of the spillage, the type of pollutants spilled, as well as the current levels of those pollutants already present within the watercourse.

9.8.3 The risk of a significant spill and/or leak can be minimised by following standard good practice with regard to pollution prevention as part of the appointed contractor's environmental management plan. It is also recommended that any concrete pouring and filling works are monitored by the appointed contractor and spill prevention and remediation measures are in place to minimise the risk and extent of spills and to rapidly

deploy clean up equipment. Therefore, providing that pollution prevention guidelines are adhered to any risk of accidental spillages should be minimised and should result in **no impact**.

IMPACT: Sediment Re-suspension during Construction

9.8.4 Construction works involve re-grading and widening of the river up to 1.5km upstream of town and 400m downstream of Seamus Rafter Bridge, and would take place predominantly within the river. Excavation and re-grading could release sediment into the water column, forming a sediment plume and affecting water quality in terms of suspended sediment concentrations and associated affects on the water's turbidity and transparency. The sources of sediment plumes are essentially the losses, deliberate and otherwise, that occur during this type of operation. Increases in turbidity, as a result of in-river works, affect the water quality, both physically and indirectly as it affects the chemical and biological quality of the river.

9.8.5 While in-river works are temporary, they may still result in sediment plumes within the water column. The magnitude of the effect is considered low as the volume of material that would be re-suspended is considered to be limited given the nature of the river bed sediments and localised nature of the works, though the sensitivity is medium due to the good water quality within the river and the localised effect of increased suspended sediments; consequently, a potential **minor negative impact**.

Mitigation Measures

9.8.6 Appropriate mitigation measures should be employed, which would entail aspects such as the use of silt screens, enclosing areas to work in the dry, excavating riverbanks during periods of low water level, and other measures to prevent the release of large quantities of sediment at one time. These measures should be identified within the Detailed Design Phase, and should form part of the contract for works.

Residual Impact

9.8.7 Provided the appropriate mitigation measures and methods of working are employed that would prevent the significant disturbance to the river's bed and banks, or ensure management of suspended sediments (e.g. reduced entrainment and control), the impact should reduce to a **negligible residual impact**.

IMPACT: Contaminant Mobilisation during Construction

9.8.8 The widening of the river and re-grading of lengths of the riverbed could result in the re-mobilisation of potentially contaminated material. Material that is chemically contaminated could result in significant negative effects to the health of faunal species of all kinds within the river. Given the conservation status of the species present in the river the sensitivity of the receptor is considered to be very high. The widening works would be undertaken during periods of low flow and as such there would minimal deposition of material into the river. The river bed re-grading works is expected to result in movement of sands and gravels with only limited fines, and the works would be undertaken in a localised area with limited potential for large volumes of material to be re-suspended. Added to this, is the low potential for contaminants to be present in the bed sediments, due to the existing sediment transport system that moves material down river as opposed to the long term build up of material (which also minimises the potential fines fraction still further) and the limited sources of potential contaminants within the river catchment (see **paragraphs 8.8.2 to 8.8.5**). Consequently, a potential **minor negative impact** could occur.

Mitigation Measures

9.8.9 Following the measures identified in **paragraph 8.8.6**, and in **paragraph 9.8.6** above, there should be significant reduction in either the amount of material re-suspended, and a reduced risk of that material being contaminated. To manage this process, a material management strategy should be produced and developed in consultation with the EPA and Wexford County Council, in order to identify appropriate reuse, recycling recovery or disposal of any material in an appropriate and licensed manner, and this would include the detailed measures to avoid the re-mobilisation of any contaminants into the water environment.

Residual Impact

9.8.10 Provided an appropriate level of soil characterisation is undertaken to determine the status, uses and levels of chemical constituents within the soil, and a waste management strategy produced to identify the required methods of handling, storing and disposing of any material in an appropriate manner, and specified measures to avoid the re-mobilisation of any contaminants into the water environment, a potential **negligible residual impact** is likely to remain on water quality, due to the localised re-suspension of material that would occur.

IMPACT: Effect on Abstractions / Discharges during Construction

9.8.11 The discharge licence 3km downstream of Enniscorthy at Brownswood (Roadstone Provinces Ltd) is for treated effluent from the washing down of trucks and from water used to suppress dust. If the construction works result in the release of suspended sediment and potential contaminant mobilisation then the subsequent reduction in water quality could result in this discharge breaking the water quality thresholds set within the licence. However, providing that the mitigation measures identified in **paragraphs 9.8.6** and **9.8.9** are employed, only negligible amounts of sediments would be re-suspended and they would not be measurable after travelling 3km through the dispersive and mixing environment of the river. Overall, a **negligible negative impact** is anticipated at worst, reducing to no impact.

9.9 Potential Environmental Impacts during Operation

IMPACT: Alteration to Hydrological Regime

9.9.1 The proposed scheme incorporates river-widening works both in the 400m river stretch directly downstream of the Seamus Rafter Bridge and in the 1.25 km stretch upstream of the railway bridge, as well as the 1.25km Diversion Channel that commences downstream of the Riverside Park Hotel. These works convert an area of existing floodplain (>40ha of neutral grassland) to a new berm area of aquatic habitat. Medium to high flows with various combinations of tidal influence will flood out onto this berm thereby providing an area alternatively exposed or under water. Consequently, there would be no significant changes in hydrology during low and medium flows. There will be a significant reduction in extreme flood water flows and levels both within and upstream of the town (as shown on **Figure 9.6**) and a reduced range of extreme flow velocities in these areas, as shown on **Figure 9.7** and the difference between the current situation shown on **Figure 9.8**. In extreme events the flood flow velocities will decrease predominantly as a result of the proposed scheme. This should also stabilise deposition and erosion processes that could arise during an extreme flood event, as well as reduce possible health and safety risks in the event of anyone falling in to the river.

Figure 9.6 Calculated River Level during a 100 Year Flood Event with the Proposed Scheme

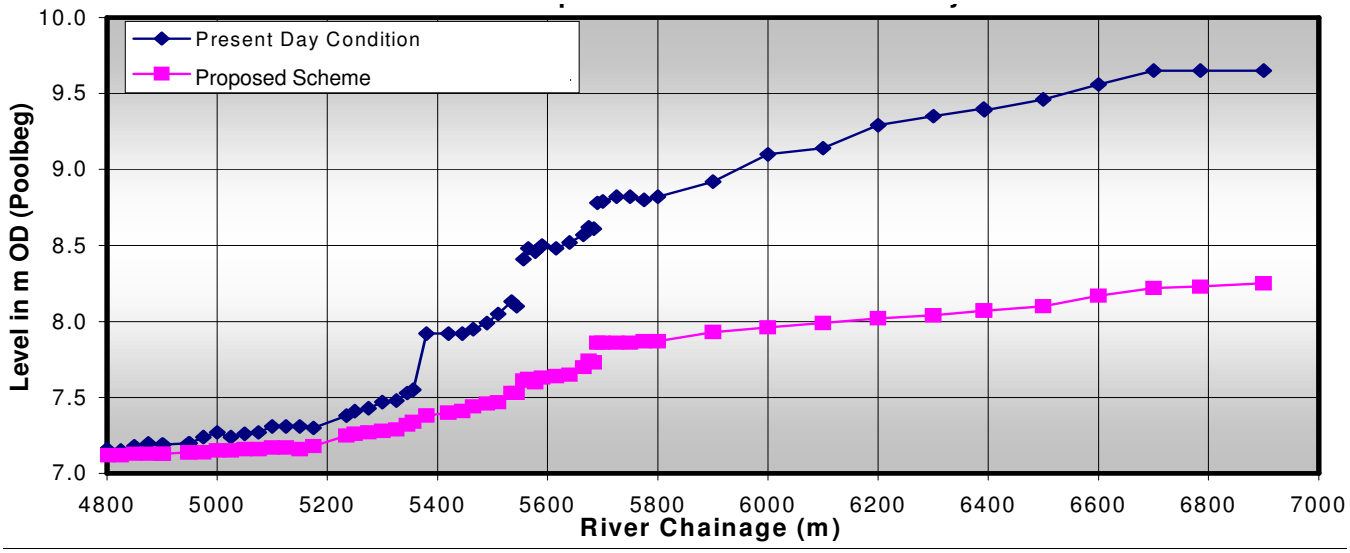
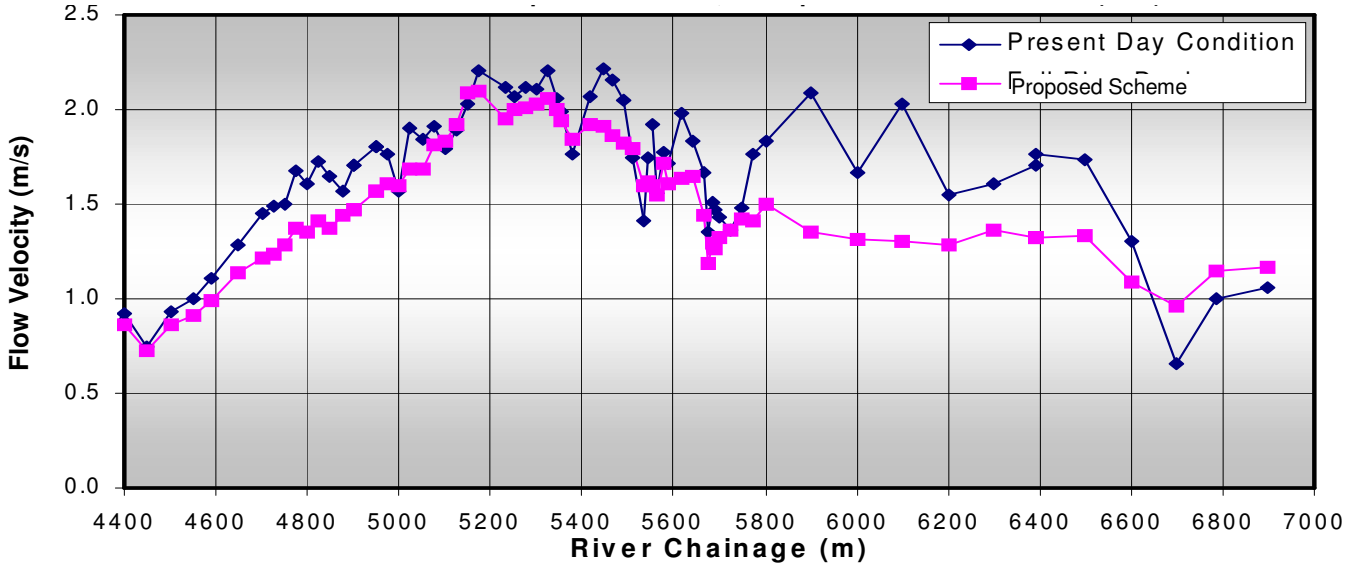
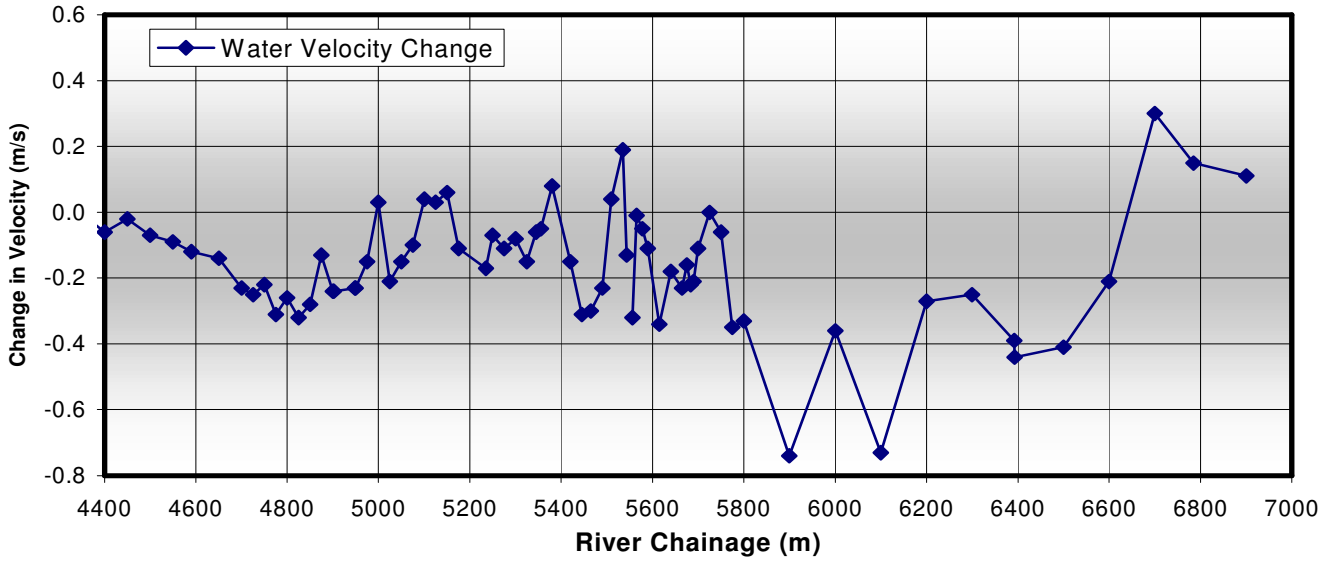


Figure 9.7 Calculated River Flow Velocity during a 100 Year Flood Event with the Proposed Scheme



9.9.2 Some localised changes in flow will occur within the town where river bed re-grading is proposed. At present, flood flow velocities are slower upstream of Enniscorthy Bridge and the railway bridge and faster downstream of them. This results in sediment deposition immediately upstream and erosion downstream of their locations and the creation of downstream pools. The lowering of the bridge inverts will result in localised changes in flow, and a reduction in the size of the 'pools' associated with the current hydrological and physical profile.

Figure 9.8 Calculated Difference in River Flow Velocity between Current Situation and with the Proposed Scheme



9.9.3 During low and medium flows the river would be maintained within its existing channel. However, during high water events the floodplain through the town would be shut off as a result of the flood defence measures (flood walls). The scheme would reduce water levels through the town (generally between 0.5 and 1m) and in the 1.5km stretch upstream of the town (alongside Island Street) this benefit increases to 1.25m. Three significant flood events are expected in the next 50 years; this increases to seven if the predicted climate change effects actually occur.

9.9.4 Overall, the reduction of the extreme flood water levels does not affect the critical flows (low flows) within the river, and although localised changes in flow would occur, these would not be significant across the length of the river through the town. Consequently, a **minor negative impact** is anticipated on hydrology.

Mitigation Measures

9.9.5 To ensure that there are no increases in low flow velocities as a result of the river re-grading works, the Detailed Design Phase shall incorporate a specific low flow channel within the re-grading works design. The dimension of this channel will be derived from hydrographic readings of water levels from which flow volumes can be derived to determine the 5% flow rates. Based on these, a low flow channel cross-section will be designed, and a low flow channel route identified on the Detailed Design plans. The design of the low flow channel will be discussed and agreement gained with the Eastern Regional Fisheries Board, as well as consultation undertaken with interested parties, such as the Slaney River Trust.

Residual Impact

9.9.6 Provided the low flow channel is built into the scheme, there would be no obstruction or hindrance to water flow at all states of the river, and the reduction of very high velocities during extreme events results in a **moderate positive impact** in relation to stability of the river and its hydrological system.

I

MPACT: Sediment Re-suspension during Operation

9.9.7 As described in **paragraphs 9.9.1** and **9.9.2**, there is a potential for changes in high flow rates through the study area resulting from geomorphological changes. However, the difference in suspended sediment levels during flood flows compared to the current levels across the river is unlikely to be noticeable above existing natural variation. Consequently, **no impact** is expected.

IMPACT: Effect on Abstractions / Discharges during Operation

9.9.8 One abstraction point is located over 1km further upstream of the proposed flood defences. The resulting flood levels for the proposed scheme would be 1.25m lower than at present and a significant reduction in flooding in this area compared to present day conditions. Three significant flood events are expected in the next 50 years; this increases to seven if the expected Climate Change effects actually occur. As these are short lived and infrequent, this is considered to provide a **negligible positive impact**.

9.9.9 The one active discharge licences is about 3km downstream of Enniscorthy at Brownswood (Roadstone Provinces Ltd). General river flows would be unaltered while extreme flood flows would be marginally higher than at present and, as such, the proposed scheme will not impact the existing discharges or their dispersal. Consequently, **no impact** is expected.

9.10 Monitoring

9.10.1 Other than water quality monitoring that may be required as part of the waste licensing procedures, no other monitoring is required.

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10 AIR

10.1 Introduction

10.1.1 This section examines the attributes relating to air quality, and the potential effects of the proposed scheme during construction and operation. In particular, it considers the emissions from road traffic as a result of the new bridge and new road routes within Enniscorthy.

Legislative Framework for Air Quality

10.1.2 Air quality standards set down in the European Union Air Quality Framework Directive[1] were transposed into Irish law through the Environmental Protection Agency Act 1992 (Ambient Air Quality Assessment and Management Regulations) 1999[2].

10.1.3 Current Air Quality Standards in Ireland are derived from European Union 'daughter' directives which set limit values for specific pollutants[3], and were transposed into Irish law through the Air Quality Standards Regulations 2002[4] and the Ozone in Ambient Air Regulations 2004[5]. The Air Quality Standards Regulations 2002 specify the dates by which the limit values or target values for each of the pollutants must be achieved (set out in **Table 10.1**).

10.1.4 In accordance with the Air Pollution Act 1987, local authorities (County Councils, City Councils, Borough Councils and Town Councils) are obliged to take whatever measures they consider necessary to prevent or limit air pollution in their area. Where there is a risk of exceeding limit values outlined in **Table 10.1**, the local authority may be required to implement a short-term action plan to maintain the pollutant levels within the prescribed limits.

10.1.5 The Environmental Protection Agency (EPA) operates the majority of air pollution monitoring sites in the country, outside of Dublin and Cork. The EPA may identify a need for control measures in a particular area in order to comply with the 2005 or 2010 standards and the relevant local authority would be required to introduce such measures by way of an air quality management plan.

Sensitive Receptors for Emissions to Air

10.1.6 Possible exceedences of the air quality objectives set out in **Table 10.1** are usually assessed at locations where relevant public exposure would be expected given the averaging period for the pollutant in question. This includes locations which are situated outside of buildings or other natural or man made structures, above or below ground, and where members of the public are regularly present.

[1] COUNCIL DIRECTIVE 96/62/EC of 27 September 1996 on ambient air quality assessment and management.

[2] Environmental Protection Agency Act, 1992 (Ambient Air Quality Assessment and Management Regulations, 1999. S.I. No. 33 of 1999.

[3] *First Daughter Directive (1999/30/EC) and Second Daughter Directive (2000/69/EC) Third Daughter Directive (2002/2/EC).*

[4] Air Quality Standards Regulations, 2002, S.I. No. 271 of 2002.

[5] Ozone in Ambient Air Regulations, 2004. S.I. No. 53 of 2004.

Table 10.1 Air Quality Limit Values for the Protection of Human Health[4]

Pollutant	Objective		Date to be Achieved By
	Concentration	Measured as	
Objectives for the Protection of Human Health			
Benzene	5μg/m^3	annual mean	1 January 2010
Carbon Monoxide	10mg/m^3	maximum daily running 8-hour mean	1 January 2005
Lead	0.5μg/m^3	annual mean	1 January 2005
Nitrogen dioxide	200μg/m^3 not to be exceeded more than 18 times a year	hourly mean	1 January 2010
	40μg/m^3	Annual mean	1 January 2010
Particles, PM_{10} (gravimetric) Stage 1	50μg/m^3 not to be exceeded more than 35 times a year	24 hour mean	1 January 2005
	40μg/m^3	annual mean	1 January 2005
Sulphur Dioxide	350μg/m^3 not to be exceeded more than 24 times a year	hourly mean	1 January 2005
	125μg/m^3 not to be exceeded more than 3 times a year	24 hour mean	1 January 2005

Airborne Pollutants

10.1.7 The atmospheric pollutants considered in this assessment are NO_2 and PM_{10}. These are the main pollutants of concern in the area of the proposed development. They are generally associated with road traffic. These pollutants can have an adverse effect on human health and the environment, as described in **Table 10.2**. Airborne dust and odour during the construction period are also considered.

Significance of Impacts to Air Quality

10.1.8 The significance of the impacts are discussed in the context of the national air quality standards detailed in the Air Quality Standards Regulations[4]. Qualitative assessments (i.e. descriptions) of construction impacts due to the proposed scheme are as described in **Section 4.6**. Quantitative assessments of operational impacts are described following National Roads Authority (NRA) guidelines[6] as outlined in **Appendix 11**.

[6] National Roads Authority, *Guidelines for the Treatment of Air Quality during Planning and Construction of National Road Schemes*.

Table 10.2 Key Atmospheric Pollutants Considered in this Assessment

Species	Description	Impacts	
		Health	Environmental
NO_x	NOx is a term used to describe the mixture of nitrogen oxides which are emitted from combustion reactions in both industry and vehicle engines.	Nitrogen dioxide (NO2) is the primary concern for effects on health, and is the species for which the health-based standard is expressed. Nitrogen dioxide (NO2) is associated with both acute and chronic health effects, particularly in people with asthma. At high concentrations, it can cause inflammation of the airways and might predispose people to an increased risk of respiratory infections7.	The various oxides of nitrogen can also react with hydrocarbons in the atmosphere to contribute to the formation of ozone. Nitrogen oxides can also affect ecologically sensitive sites through deposition, causing acidification and eutrophication. Eutrophication can affect a range of ecosystems, including an increase in the productivity of phytoplankton blooms in ocean waters.
PM_{10}	Fine particulate matter (PM_{10}) includes a variety of particles, but includes minerals, combustion (carbon) products, or natural materials (e.g. sand and sea salt) which are small enough to be inhaled and many of which will reach the lower (gas exchange) region of the lungs. PM_{10} particles are those with a mean aerodynamic diameter of less than 10 micrometers.	There is evidence that exposure to elevated levels of fine particles is associated with both cardiovascular and pulmonary effects in susceptible individuals[8].	Impacts on climate through cloud forming 'hygroscopic' nuclei, and effects on cloud physics and radiative balance.

10.2 Methodology

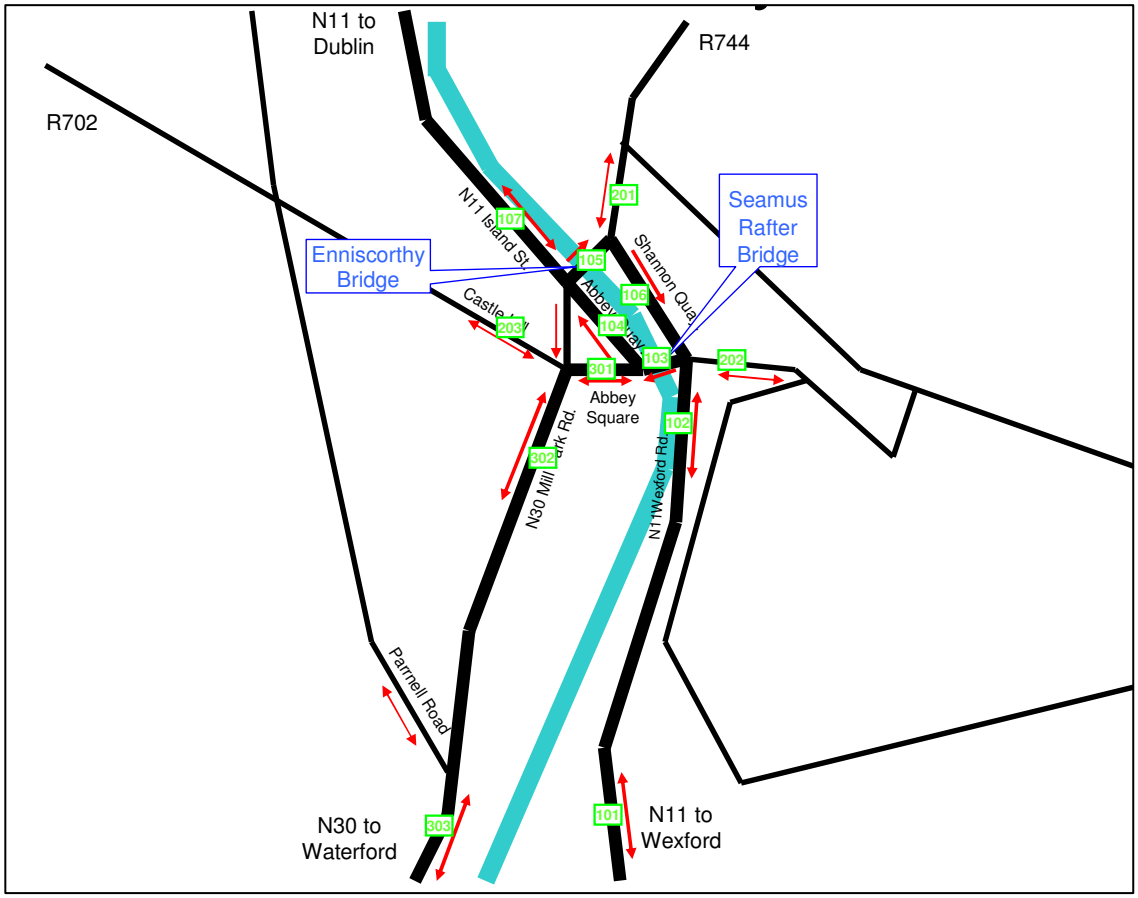
10.2.1 On-road vehicle exhaust emissions were assessed on main roads within the Enniscorthy that are linked to the Seamus Rafter Bridge and the roads it influences, see **Figure 10.1**, and the traffic volumes are identified **Table 5.1**. Existing (2007) year emissions, and opening (2012) and future (2027) impacts from on road vehicle emissions without and with the proposed scheme were calculated using the air quality calculation file downloaded from www.highways.gov.uk/business/238.aspx. The calculation data entry tables and subsequent results tables are presented in **Appendix 14**.

10.2.2 Background levels monitored in County Wexford by the EPA were also obtained.

[7] Expert Panel on Air Quality Standards (1998). *A Recommendation for a United Kingdom Air Quality Standard for Nitrogen Dioxide*, HMSO, London.

[8] Expert Panel on Air Quality Standards (1995). A Recommendation for a United Kingdom Air Quality Standard for Particles, HMSO, London.

Figure 10.1 Existing Traffic Routes Examined in this Study



10.3 Surveys

10.3.1 No air quality surveys were undertaken, however, the road traffic vehicle count data was taken in 2007 (DBFL, 2008).

10.4 Consultation

10.4.1 No specific consultation has been carried out with respect to air quality.

10.5 Baseline Environment

Background Concentrations

10.5.1 Site-specific background pollutant estimates were not available; therefore, background concentrations of NO_x and Particulates were derived from the monitoring currently being undertaken at Carnsore Point (www.epa.ie/whatwedo/monitoring/air/data/cs/pm/), which shows particulates (PM_{10}) averaging around 17µg/m^3, whilst NO_x is averaging 24ppb (parts per billion). Future concentrations were predicted using year adjustment factors available from the UK Air Quality Archive[9] (UKAQA), as advised by the NRA[6].

[9] http://www.airquality.co.uk

Existing Sources of Emissions to Atmosphere

10.5.2 Road traffic is the major source of emissions to atmosphere within the Enniscorthy area.

Existing Sensitive Receptors

10.5.3 **Table 10.3** presents the number of properties within the band widths of the existing routes and road alignments which result in changed vehicle flow numbers in the with scheme scenario. Calculations of local and regional air quality and emissions are presented in **Appendix 14**.

Table 10.3 Property Band Widths (m from road centre) for the Existing Road Alignment

Road Segment	Existing (m)				
	0 - 20	20 - 50	50 - 100	100 - 150	150 - 200
N11 Wexford Road	0	3	29	60	89
Seamus Rafter Bridge	0	4	17	31	69
Abbey Square	1	19	34	76	71
New Bridge	0	0	21	36	24
Mill Park Rod (N30)	39	42	109	132	82

10.5.4 The key sensitive receptors adjacent to the road network is the school adjacent to the N30 Waterford Road, which is close to the proposed bridge junction with the N30 Waterford Road, and the Slaney Valley cSAC. However, the Slaney Valley cSAC is not carried further as the same number of vehicles will cross over the river, with the scheme, except the crossing would be in another location.

10.5.5 **Table 10.4** presents the current levels of the key air quality parameters based on 2007 traffic levels at the nearest sensitive receptor (shown on **Figure 10.2**). It is clear from the results that pollutant levels from road traffic emissions at this receptor, and likely at any other residential receptor, fall well below the national air quality objective thresholds for NO_x and PM_{10}. Over the next 20 years these levels are generally expected to fall due to improvements in vehicle efficiency, though in some cases the predicted growth in traffic volumes reduces the amount levels would fall in some cases. Based on the calculations for the closest residential receptor, no sensitive receptor that falls within 200m of the associated road experiences high levels of pollutants, and all fall significantly below air quality targets.

10.5.6 Regional pollutant emissions were calculated for road segments relevant to Enniscorthy, for 2007, and are presented in **Table 10.5**. The volumes are insignificant compared to County levels of emissions.

Table 10.4 Nearest Residence Local Air Quality Calculation Results for 2007

Receptor	NO_x	PM_{10}	
	Annual mean µg/m^3	Annual mean µg/m^3	Days >50µg/m^3
	30	40	35
The School	15	13.7	0

Table 10.5 Regional Air Quality Calculations for 2007

CO	THC	NOx	PM10	C
(kg/year)	(kg/year)	(kg/year)	(kg/year)	(tonnes/year)
26,354	3,867	21,223	659	**1,637**

10.6 Do Nothing Scenario

10.6.1 Exceedences of air quality limit values are not expected within Enniscorthy. Emissions of key air pollutants (NO_x and PM_{10}) from road transport have fallen by about 50% over the last decade, despite increases in traffic, and are set to reduce by a further 25% or so over the next decade[10]. This is mainly a result of progressively tighter vehicle emission and fuel standards agreed at European level and set in Irish regulations. It is predicted that emission of pollutants in Enniscorthy would follow the national trend without development of the proposed scheme.

10.6.2 **Table 10.6** presents the calculated levels of the key air quality parameters in 2012 and 2027 'without' the junction works at the nearest sensitive receptors. Pollutant levels change only slightly, but remain well below any of the national air quality objective thresholds.

10.6.3 Regional pollutant emissions were calculated for road segments relevant to Enniscorthy, for years 2012 and 2027, and are presented in **Table 10.7**. The volumes are insignificant compared to County levels of emissions. However, even with improving vehicle efficiency, due to the predicted increases in traffic volumes total emissions for carbon monoxide, hydrocarbons (THC), and carbon will continue to increase, though to a lesser extent than the increasing traffic volumes.

[10] DEFRA, April 2006, *The Air Quality Strategy for England, Scotland, Wales and Northern Ireland, A Consultation document on options for further improvements in air quality, Volume 1.*

Figure 10.2 Routes with Altered Traffic Flows with the Scheme, and Sensitive Receptor

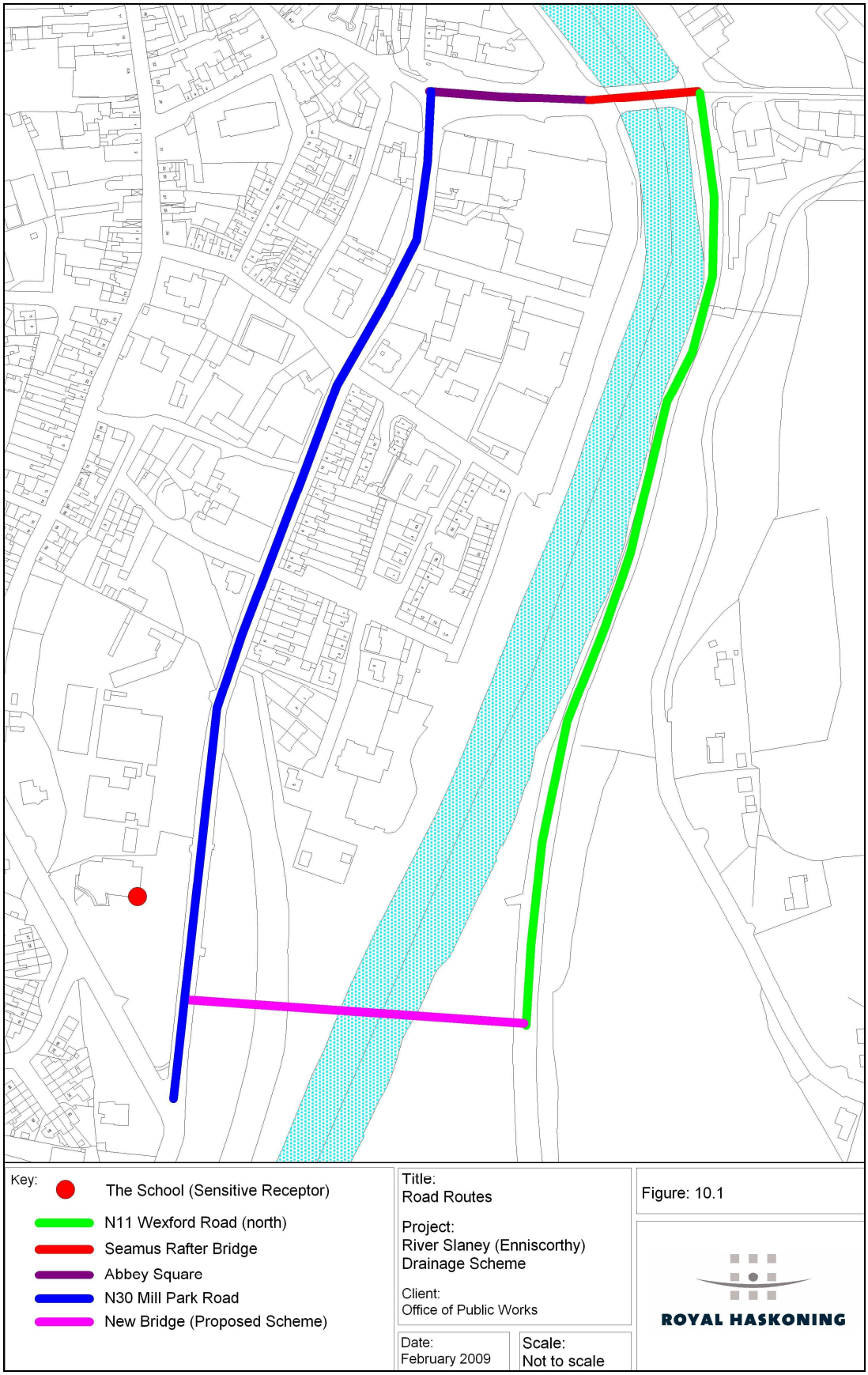


Table 10.6 Nearest Residence Local Air Quality Calculation Results for The School Along Mill Park Road (N30)

Year	NO_x	PM_{10}	
	Annual mean $\mu g/m^3$	Annual mean $\mu g/m^3$	Days $>50\mu g/m^3$
	30	40	35
2012	15	14.9	0
2027	15	15.9	0

Table 10.7 Regional Air Quality Calculations for 2012 and 2027

Year	CO	THC	NOx	PM10	C
	(kg/year)	(kg/year)	(kg/year)	(kg/year)	(tonnes/year)
2012	25,775	3,680	16,523	458	1,741
2027	27,944	3,959	17,487	491	1,869

10.7 Potential Environmental Impacts during Construction

IMPACT: Traffic Derived Emissions to Air during Construction

10.7.1 No detailed method or quantities are currently identified for the construction phase, however, even assuming 20 HGV movements of materials each day, which is unlikely, the number of HGVs is around or less than 1% of the current daily movements of HCVs. Consequently, no noticeable change in air quality would arise, and a **negligible impact** would occur.

10.8 Potential Environmental Impacts during Operation

IMPACT: Traffic Derived Emissions to Air during Maintenance of the Proposed Flood Alleviation Scheme

10.8.1 No detailed method or quantities are currently identified for the maintenance aspects of the proposed scheme. However, maintenance is unlikely to consist of more than a JCB on site at the sediment trap, extracting material which would be transported to an alternative use site. These works would be small in scale and localised, and the number of HGV movements would be significantly less than the current number of HCVs that pass through Enniscorthy. The maintenance works would be infrequent occurrences, and would only extend for a short duration. Consequently, a **negligible impact** would occur.

IMPACT: Traffic Emissions at Sensitive Receptors

10.8.2 **Table 10.8** presents the results of the calculations of the key road traffic pollutant emissions for the nearest sensitive receptor (the school shown on **Figure 10.1**). The table also compares the results against the 'do nothing' or 'without' works scenario. Due to the existing low levels of road traffic derived pollutants, the results indicate that the levels of pollutants would be greater in the opening year, but only very slightly greater by the design year (2027) as a result of the proposed new bridge and associated route changes. However, the increases are minor in magnitude, being less than 1% for any pollutant parameter toward the design year, and the pollutants all remain below existing (present

day) emissions levels, even with increased traffic volumes. Overall therefore, there would be **no impact** on air emissions, at a localised level.

10.8.3 Overall, properties will experience a negligible increase compared to the do-nothing scenario, and levels would predominantly lie below present day emissions levels, and would continue to remain significantly below air quality target levels. Consequently, **no noticeable impact** is expected on air quality.

Table 10.8 Nearest Receptor Local Air Quality Calculation Results for the With and Without Scheme Scenarios

With / Without Junction Works	Year	NO_x	PM_{10}	
		Annual mean $\mu g/m^3$	Annual mean $\mu g/m^3$	Days $>50\mu g/m^3$
		30	40	35
Without	2007	15	13.7	0
Without	2012	15	14.9	0
With	2012	15	15.9	0
Without	2027	15	15.9	0
With	2027	15	16.0	0
With + Bypass	2027	15	16.3	0

IMPACT: Total Traffic Emissions in the Study Area

10.8.4 **Table 10.9** presents the regional emissions with and without the scheme. The 'without scheme' scenario is the equivalent of the 'do nothing' scenario. The scheme would result in higher total emissions compared to the 'do nothing' scenario in the opening year, with overall increases of 8.5% of carbon monoxide, 7.7% of total hydrocarbons (THC), 6.4% of nitrogen oxides, 7.7% of particulates, and 7.2% in carbon. At a local level these changes are potentially moderate, but at the county and regional level the emissions are negligible in terms of county levels of traffic emissions. Therefore, a **negligible negative impact** is anticipated.

Table 10.9 Regional Air Quality Calculations

Year	With / Without Junction Works	CO	THC	NOx	PM10	C
		(kg/year)	(kg/year)	(kg/year)	(kg/year)	(tonnes/year)
2007	Without	26,354	3,867	21,223	659	1,637
2012	Without	25,775	3,680	16,523	458	1,741
	With	27,944	3,959	17,487	491	1,869
2027	Without	30,640	4,421	15,104	427	2,073
	With	33,250	4,760	16,065	460	2,223

10.9 Monitoring

10.9.1 No monitoring requirements are to be undertaken.

11 NOISE AND VIBRATION

11.1 Introduction

11.1.1 This section examines the potential noise and vibration effects of both the construction and operation of the proposed Enniscorthy Drainage Scheme. It reports the results of a desk top study assessing the noise levels for the construction and the operational phases of the scheme.

11.1.2 The desk top study included assessment of noise from construction works for the whole scheme, and of operational noise from the proposed new bridge and the associated link roads. The desk top study therefore considered the following:

- Construction phase: noise generated on- and off-site during the construction of the scheme from both the operation of items of fixed and mobile construction plant and machinery as well as the movement of construction related traffic; and
- Operation: noise generated by changes in road traffic flows.

11.1.3 The assessment of the proposed scheme utilised the scheme description in **Section 3.4**.

11.1.4 Only potential noise and vibration impacts affecting human receptors are considered in this section, ecological receptors are dealt with in their respective chapters on construction disturbance in **Sections 6** and **7**.

11.1.5 A glossary of acoustic terminology is included in **Appendix 11**.

11.2 Legislation and Guidelines

11.2.1 The noise and vibration assessment makes reference to the following general guidance documents for noise:

- National Roads Authority [NRA] “Guidelines for the Treatment of Noise and Vibration in National Road Schemes” (NRA, 2004). While the guidelines are primarily designed for the planning, construction and operation of new road schemes, they also contain useful guidance for assessing noise impacts from traffic and for acceptable limits for construction noise;
- Department of Transport [DoT] “Calculation of Road Traffic Noise” (DoT, 1988) [CRTN]. This document provides a method for assessing noise from road traffic, in the UK. The calculation methods provided include correction factors to take account of variables affecting the creation and propagation of road traffic noise including the percentage of heavy goods vehicles, different road surfacing, inclination, screening by barriers and relative height of source and receiver;
- British Standard [BS] 5228: Part 1: 1997 “Noise and vibration control on construction and open sites” (BSI, 1997b). BS 5228 provides guidance on the causes of construction noise and presents several methods for predicting noise levels from construction sites affecting nearby sensitive receptors. The standard includes source noise levels for typical items of fixed and mobile plant equipment found on construction sites; and
- Department for Environment Food and Rural Affairs [DEFRA] “Update of noise database for prediction of noise on construction and open sites” (DEFRA 2006b).

The document contains updated values for noise levels from construction plant and equipment which should be used in preference to the older data in BS 5228.

11.3 Assessment Methodology

Assessment of Construction Noise

11.3.1 An outline of the proposed construction programme for the proposed scheme is given in **Section 3.4**, based on the preliminary concept design. The assessment of construction noise used the following data:

- The description of construction works associated with the scheme in **Section 3.4**, describing the likely construction methods and required plant and machinery; and
- Geographical location of construction works indicated in **Figure 3.14** and **3.17**.

11.3.2 The impact of noise associated with the construction of the proposed scheme was assessed using the guidance contained in BS 5228: Part 1 (BSI, 1997b). The standard provides a method for predicting noise levels from construction activities affecting surrounding noise sensitive properties. It includes various correction factors for attenuation of the noise due to distance, screening by buildings or topography, the different effects of hard or soft ground between source and receptor and the period of the working day that equipment operates at full power (the 'on-time'). The predicted construction noise levels are free-field external noise levels at the selected receptor property.

11.3.3 Generic noise levels associated with the plant and equipment were taken from BS 5228 Part 1 (BSI, 1997b) and from "Update of noise database for prediction of noise on construction and open sites" (DEFRA, 2006b).

11.3.4 It should be noted that BS 5228 states that caution should be paid to noise predictions at distance greater than 300 metres from the source. The potential for local meteorological conditions to affect sound propagation may produce localised noise augmentation or attenuation resulting in actual noise levels different to those predicted.

11.3.5 There is no published Irish guidance for the maximum permitted noise level associated with construction works. Local authorities usually control construction activities by imposing limits on the hours of operation and may consider noise limits appropriate to the existing noise environment in the area.

11.3.6 The NRA guidance on assessing noise from road schemes states that "The Authority considers that the noise levels in Table 1 [sic] are typically deemed to be acceptable" (NRA, 2004 p13). The table of NRA recommended maximum noise levels is presented in **Table 11.1**.

11.3.7 The NRA recommended noise levels in **Table 11.1** are described as indicative only, with more stringent limits possibly being appropriate in areas with pre-existing low noise levels. For the Enniscorthy scheme, the levels in **Table 11.1** are judged to be representative of reasonable noise limits associated with construction projects, balancing the practicalities of construction with protection of amenity for nearby residents. The NRA guidance values were therefore taken as maximum acceptable noise limits for temporary construction activities associated with the scheme.

Table 11.1 Maximum Permissible Noise Levels at the Façade of Dwellings during Construction

Days and times	$L_{Aeq(1hr)}$ dB	$L_{PA(max)slow}$ dB
Monday to Friday 07:00 to 19:00	70	80
Monday to Friday 19:00 to 22:00	60[2]	65[2]
Saturday 08:00 to 16:30	65	75
Sunday and Bank Holidays 08:00 to 16:30	60[2]	65[2]

[2] Construction activity at these times, other than that required in respect of emergency works, normally requires explicit permission from local authority

Source: NRA, 2004.

11.3.8 **Table 11.1** gives permissible façade noise levels which include reflected noise from the dwelling. The noise model used to calculate construction noise calculates the free-field noise level. BS 5228 Part 1 recommends that an allowance for reflection from a building should be made by adding 3 dB to the calculated free-field level.

11.3.9 On-site construction noise impact magnitude was assigned according to the arithmetic difference between the acceptable façade noise limits in **Table 11.1** the predicted free-field noise levels plus 3 dB.

11.3.10 There was insufficient quantitative information at this time regarding the numbers and proposed timescales of construction traffic movements to carry out a detailed quantitative assessment of construction transport-related noise. A qualitative assessment was therefore made, based on current traffic levels and our experience of similar construction schemes.

Assessment of Road Traffic Noise

11.3.11 When the Enniscorthy Flood Relief Scheme has been completed, there is potential for increased noise levels from the modified traffic flows introduced by the new bridge.

11.3.12 The NRA "Guidelines for the Treatment of Noise and Vibration in National Road Schemes" (NRA, 2004) provide guidelines designed for the planning, construction and operation of new road schemes. The guidelines give two methods for predicting noise from road traffic levels from AADT average traffic profile flows including the percentages of HGVs. It uses CRTN methodology to calculate L_{A10} noise levels which are then processed to give the L_{den} (day, evening, night) noise level for the for the road traffic.

11.3.13 Assessment of potential noise impacts due to road traffic generated by operation of the scheme were assessed by predicting the traffic noise levels associated with traffic flows in the 'with' and 'without' scheme situations, the 'Do Nothing' and 'Do Something' scenarios respectively. Traffic noise predictions were carried out using the NRA recommended methodology Method B (NRA, 2004 p18).

11.3.14 Traffic noise impact magnitude was assigned according to the arithmetic difference between the traffic noise calculated for the 'Do Something' scenario and the 'Do Nothing' scenario.

Noise Impact Significance Criteria

11.3.15 The noise impact significance depends on the noise level impact magnitude and has been described according to the criteria defined in **Table 11.2**.

Table 11.2 Noise Impact Significance Criteria

Noise Level Change (Impact Magnitude)	Noise Impact Significance
< 3 dB change	Negligible
3 to 4.9 dB change	Minor
5 to 9.9 dB change	Moderate
> 10 dB change	Major

11.3.16 The significance criteria were derived from two reference sources:

- BS 4142: 1997 (BSI, 1997a) "Method for rating industrial noise affecting mixed residential and industrial". This document recommends that an increase in noise levels of 5 dB is of "marginal significance" whilst a 10 dB increase in noise levels indicates that complaints are likely; and
- Research (Bies and Hanson, 2003) which found that for a person with normal hearing, 3 dB was the least audible change in general environmental noise levels, whilst a 5 dB change would be clearly audible and a 10 dB change would be perceived as a doubling of the noise.

Assessment of Vibration

11.3.17 With regard to potential vibration impacts from road traffic, the National Roads Authority (NRA) guidance document states that "ground vibrations produced by road traffic are unlikely to cause perceptible structural vibration in properties located near to well-maintained and smooth road surfaces" (NRA, 2004, p39). Vibration from road traffic was not assessed further, and it was concluded that there will be no vibration impacts from road traffic.

11.3.18 Vibration from construction activities has the potential to generate higher levels of vibration than road traffic. Construction vibration may be either air-borne or ground-borne. Air borne vibration generally arises as the result of the operation of diesel powered equipment or other sources of low frequency sound energy and can manifest itself as the rattling of doors, windows, loose fittings and, in extreme cases, as the vibration of ornaments within dwellings. Ground-borne vibration can arise from piling or the movements of heavy plant equipment and vehicles on construction sites or public roads.

11.3.19 The NRA guidelines set out allowable ground-borne vibration levels during road construction at the closest part of a sensitive property. Source vibration levels and the propagation of vibration is very site specific, dependant on ground and soil type, depth and

type of foundations, depth of bedrock etc. At this time, the detailed information necessary to undertake quantitative assessment is not available. The potential for vibration impact is highest for the now footbridge piling and Seamus Rafter Bridge demolition works on Abbey Quay. Based on typical vibration levels given for piling in BS5228 Part 4 (BSI 1992) at a distance of 50m or more, it assessed that there is no potential for vibration damage to building levels from the construction works. Vibration from construction was not assessed further, and it was concluded that there will be no vibration impacts from construction works.

11.4 Data Sources

11.4.1 The noise and vibration assessment used the following reports as sources for data:

- NRA "RT620 - National Roads and traffic flow 2004" (2005);
- NRA "Future Traffic Forecasts 2002-2040" (2003);
- Mott MacDonald Pettit "New River Slaney Bridge Crossing at Enniscorthy – Preliminary Bridge Options Report" (2008); and
- DBFL "Traffic study for Enniscorthy, Co.Wexford" (2008).

11.5 Surveys

11.5.1 No baseline noise or vibration surveys were carried out.

11.6 Consultation

11.6.1 No specific consultation has been carried out with respect to noise and vibration.

11.7 Baseline Environment

11.7.1 Enniscorthy is a market town with a population of about 10,000. There is no major industry in the town and the significant sources of noise in the area are related to transport. The N11 national primary road from Dublin to Wexford and Rosslare passes though the centre of Enniscorthy and crosses the River Slaney by two bridges. The N30 road from New Ross and Waterford to the west connects with the N11 in Abbey Square in the centre of the town. The Dublin to Wexford railway line passes through the town, with a station to the north of the river.

11.8 Noise Model

11.8.1 A noise model of the scheme area was constructed utilising NoiseMap software. The RoadNoise module was used to predict traffic noise levels.

11.8.2 A terrain model of the study area was constructed from data obtained from Ordnance Survey Ireland. Spot heights and contour lines were used to define the topography. Contours used 5m vertical intervals close to receptors where the terrain relief could have a significant effect on the noise levels and up to 20m vertical interval towards the edges of the model where the terrain would have less effect on the noise.

11.8.3 Buildings were considered significant where their location was likely to have an effect on the noise level at any of the receptor points either by noise shielding or reflection. Only significant buildings were included in the noise model, modelled as barriers. The heights

of the barriers representing the buildings were set to the height of the roof line of the relevant building. Building heights were estimated from photographs.

11.8.4 Representative noise receptor positions were modelled at each of the identified Noise Sensitive Receptor (NSR) buildings. The building façades potentially subject to noise impacts were modelled with a receptor point 1m from the significant facade. All receptor points were located at 4.0m above local ground level. The Ordnance Survey Ireland grid reference and height above datum in metres of the noise receptor points used in the model are listed in **Table 11.3**. The noise levels predicted at the receptor points were free-field levels, i.e. without the contribution from the noise reflected by the adjacent façade.

Table 11.3 Details of Noise Receptor Points

No.	Receiver Point	OSI Grid Reference		H
		X	Y	
1	Templeshannon	297591	139964	25.0
2	Shannon Quay	297469	139922	9.4
3	Slaney Place	297379	139880	10.1
4	Abbey Square	297457	139776	9.3
5	Abbey Quay	297470	139786	8.4
6	The Promenade	297438	139475	8.3
7	St.John's Terrace	297304	139446	13.9
8	St.John's Road (school)	297237	139346	15.9
9	Riverside Park Hotel, south facade	297366	139318	8.5
10	Riverside Park Hotel, river facade	297394	139347	7.8
11	Esmonde Road	297576	139365	36.5
12	Munster Hill (hospital)	297074	139201	25.0

11.8.5 Major roads in the study area were modelled using spot heights to define the road vertical profiles. All roads were assumed to have a traffic speed of 50 km/h, a width of 7m and a standard road surface.

11.8.6 For the calculation of traffic noise levels using Method B in the NRA guidelines, 18-hour AADT traffic flow levels are required. The standard diurnal traffic profiles in Appendix 1 of the NRA guidelines (NRA, 2004 p44) were used to derive the traffic flows from 06:00 to 24:00; these were 96.8% and 92.5% of the 24 hour AADT total for non-HCV and HCV traffic respectively.

11.8.7 The percentages of HCV and non-HCV traffic in the 18-hour time period was applied to the 24-hour traffic data in **Section 5** to derive the 18h traffic flow data. This data was used in the noise model and is presented in **Table 11.4** for the current road layout and in **Table 11.5** for the future road layout with the new bridge.

Table 11.4 18h Traffic Flow Data, Current Road Layout

Road Link Name	Flow Direction	2007		2012		2027	
		Current		Do nothing		Do nothing	
		AADT	%HCV	AADT	%HCV	AADT	%HCV
Wexford Road (N11)	2W	12211	12.1%	14662	12.7%	17881	12.8%
Seamus Rafter Bridge	WB	18712	7.7%	22413	8.1%	27345	8.1%
Abbey Quay	NB	16983	7.7%	20342	8.1%	24818	8.1%
Enniscorthy Bridge	EB	16087	8.8%	19282	9.2%	23523	9.3%
Shannon Quay	SB	14032	8.2%	16812	8.7%	20511	8.7%
Island Rd (N11 north)	2W	16144	9.3%	19356	9.8%	23612	9.9%
Templeshannon (R744)	2W	10383	5.0%	11526	5.2%	12732	5.1%
Spring Valley	2W	4762	5.0%	5286	5.2%	5839	5.1%
Castle Hill (R702)	2W	8758	5.0%	9722	5.2%	10740	5.1%
Abbey Square	2W	15825	8.2%	18962	8.7%	23133	8.7%
Mill Park Rd (N30)	2W	9511	12.9%	11425	13.6%	13933	13.7%
N30	2W	5352	8.5%	6414	9.0%	7825	9.1%

Table 11.5 18h Traffic Flow Data, Road Layout with New Bridge

Road Link Name	Flow Direction	2012		2027		2012		2027	
		Do something (with new bridge)		Do something (with new bridge)		Cumulative (new bridge + bypasses)		Cumulative (new bridge + bypasses)	
		AADT	%HCV	AADT	%HCV	AADT	%HCV	AADT	%HCV
Wexford Road south(N11)	2W	14112	12.2%	17881	12.8%	14451	12.2%	19938	12.8%
New south bridge	WB	21618	7.7%	27345	8.1%	13965	7.7%	21165	8.1%
Mill Park Rd (N30)	NB	14204	13.0%	18002	13.7%	8948	13.0%	14402	13.7%
Abbey Square	2W	17922	7.7%	22669	8.1%	11291	7.7%	18135	8.1%
Abbey Quay	NB	19621	7.7%	24818	8.1%	12361	7.7%	19854	8.1%
Enniscorthy Bridge	EB	18588	8.9%	23523	9.3%	11450	8.9%	19218	9.3%
Shannon Quay	SB	16212	8.3%	20511	8.7%	10214	8.3%	16409	8.7%
Wexford Road north(N11)	SB	16212	8.3%	20511	8.7%	10214	8.3%	16409	8.7%
Island Rd (N11 north)	2W	18655	9.4%	23612	9.9%	1865	9.4%	2739	9.9%
Tempshannon (R744)	2W	11132	5.0%	12732	5.1%	11132	5.0%	12732	5.1%
Spring Valley	2W	5105	5.0%	5839	5.1%	5105	5.0%	5839	5.1%
Castle Hill (R702)	2W	9390	5.0%	10740	5.1%	9390	5.0%	10740	5.1%
N30	2W	6184	8.6%	7825	9.1%	6240	8.6%	8256	9.1%

11.8.8 The noise levels output from the noise model were $L_{A10(18hour)}$ dB at each of the receptor points. These noise levels were converted to L_{den} noise levels using the formula given in the NRA guidelines (NRA, 2004, p18):

$$L_{den} = 0.86 \times L_{A10(18hr)} + 9.86 \text{ dB}$$

11.9 Do Nothing Scenario

Road Traffic Noise

11.9.1 The 18-hour AADT traffic flow data for the 'Do Nothing' scenarios for the years 2012 and 2027 is presented in **Table 11.4**. This data was input to the noise model and used to calculate the traffic noise levels at the receptor points. Calculated noise levels are presented in **Table 11.6**.

Table 11.6 Traffic Noise Levels for 'Do Nothing' Scenario

No.	Receiver Point	'Do Nothing' L_{den} dB noise level		Change dB
		2012	2027	
1	Templeshannon	61.8	62.7	0.9
2	Shannon Quay	71.6	72.6	0.9
3	Slaney Place	72.8	73.8	0.9
4	Abbey Square	69.5	70.4	0.9
5	Abbey Quay	72.1	73.1	0.9
6	The Promenade	62.5	63.4	0.9
7	St.John's Terrace	70.3	71.3	0.9
8	St.John's Road (school)	65.7	66.6	0.9
9	Riverside Park Hotel, south facade	60.4	61.4	0.9
10	Riverside Park Hotel, river facade	62.1	63.1	0.9
11	Esmonde Road	62.1	63.0	0.9
12	Munster Hill (hospital)	57.5	58.5	0.9

11.9.2 The noise level increase for all of the receptor points is similar, a potentially negligible 0.9dB increase in L_{den} noise level due to increased traffic.

11.10 Potential Noise and Vibration Impacts during Construction

11.10.1 The construction of the proposed scheme has the potential to generate significant noise from inherently noisy activities such as piling and breaking out of hard ground, together with the on-site operation of both fixed and mobile construction plant equipment. Off-site movement of construction-related traffic also has the potential for significant noise generation. These potential sources of construction noise are assessed separately below.

IMPACT: Noise from Construction Related Traffic

11.10.2 A detailed forecast of the numbers of vehicles associated with the construction works was not available for this assessment.

11.10.3 The majority of construction road traffic associated with the scheme will arise from three main sources:

- Delivery of plant and materials to the main site compound for the construction of the new bridge;
- Arrival and departure of site personnel at the start and end of the day; and
- Transportation of excavated material from the diversion channel downstream of the Riverside Park Hotel to the deposition sites for the flow deflector berms upstream of the railway bridge.

11.10.4 Other construction traffic will be intermittent and involve small numbers of vehicle movements.

11.10.5 Experience from other major developments indicates a likely maximum during peak-construction periods of 10 HGVs per hour, equivalent to 20 one-way HGV movements. **Section 3.4** states that "the majority of material being used close to its current position" which implies this value of 20 HGV movements per hour is likely to be higher than the peak construction traffic actually seen during the construction works. However, use of this figure provides a significantly robust and conservative assessment.

11.10.6 Existing traffic flows on the roads around Enniscorthy are given in **Table 11.7** as 24-hour annual average daily traffic flow (AADT). Assuming that the peak flow of HGVs to the construction site was maintained over a 12-hour construction day, there would be an additional 240 HCV movements. By adding these construction HCV movements to the existing traffic flow, the maximum increase in traffic flow due to construction traffic can be obtained.

Table 11.7 Effect of Construction Traffic on Existing Traffic Flows

	Wexford Road (N11)	Seamus Rafter Bridge	Abbey Quay	Enniscorthy Bridge	Shannon Quay	Island Rd (N11 north)	Abbey Square	Mill Park Rd (N30)
Existing AADT (2007)	12685	19399	17607	16687	14551	16751	16411	9884
Existing %HCV	12.5%	8.0%	8.0%	9.1%	8.6%	9.7%	8.6%	13.4%
Existing HCVs	1414	1434	1302	1398	1148	1486	1294	1170
HCVs with construction	1654	1674	1542	1638	1388	1726	1534	1410
AADT with construction	12925	19639	17847	16927	14791	16991	16651	10124
%HCV with construction	12.8%	8.5%	8.6%	9.7%	9.4%	10.2%	9.2%	13.9%
% increase in AADT	1.9%	1.2%	1.4%	1.4%	1.6%	1.4%	1.5%	2.4%
Increase in %HCV	0.3	0.5	0.7	0.5	0.8	0.4	0.7	0.5

11.10.7 The added construction HCV traffic increases the total AADT vehicle flow on the surrounding roads by up to 2.4% and increases the percentage of HCVs by less than 1 percentage point. Charts 3 and 4 in CRTN suggest that at the speed limit of 50 km/h, the combination of the increase in total traffic flow and the increase in HGV percentage would result in a potentially negligible maximum 0.3 dB increase in traffic noise levels.

11.10.8 The increase in traffic on the roads due to construction traffic was therefore predicted to have a **negligible negative impact** on receptors in the area.

11.10.9 No mitigation of off-site noise from construction related traffic is required.

IMPACT: Noise from Construction Works

11.10.10 A detailed construction programme and method statement is not available at this stage of the project. An indicative assessment of construction noise levels has been carried out using typical items of construction plant that are likely to be used during the construction works for the scheme.

11.10.11 An outline description of the works to be undertaken during the construction for the proposed scheme is given in **Section 3.4**. These are assessed below.

River Widening, Narrowing and Excavation Works

11.10.12 The works would commence from the downstream end, and work their way upriver. They would require a JCB, a dumper truck and a lorry. Material transportation would use the lorry for the most part, with the dumper being used in restricted areas. The JCB would drag material to form a causeway, working its way upriver, then it would then remove the material to the design bed level. The dumper or lorry would move the excess material to the stretches where the material is required to raise the river bed. The excess materials not used for narrowing parts of the river, or for deepening the river, would be used to create the flow deflectors in the meadows upstream of the railway bridge. The works will be linear in nature, but in places will be between 10 and 20m from the nearest NSRs.

Containment Wall and Embankment Works

11.10.13 The wall and embankment works are expected to be low key and restricted to small working areas at any one time. Work would progress along the walls, with the embankment works to be undertaken when the river widening and dredging/deposition works take place. The equipment likely during the wall and embankment works would be a tipper truck, a lorry (for movement of larger amounts of material), a JCB and a crane. As the works would progress in small stages, the amount of material transported by road on any day would be small, with rock for the wall facings and concrete being the key materials to be transported. Minimum distances to NSRs are the same as for the river widening works above.

New South Bridge

11.10.14 Although the specific ground conditions on the east bank of the river where the pylon structure for the cable stayed bridge will be located, it is envisaged that the foundations will be bored piles, socketed into the underlying rock as necessary. The western abutment adjacent to the railway is likely to be a reinforced earth embankment. Therefore percussion piling is not proposed to be used on the site. The closest NSRs to the site of the new bridge construction are the Riverside Park Hotel at approximately 75m and a school on St. John's Road at approximately 100m.

New Footbridge

11.10.15 The new footbridge will be built close to the Seamus Rafter Bridge using a crane and a piling rig. Piling would be short-term in nature due to the small size of the footbridge structure and may use rotary piling. The nearest NSR to these construction works is located on the corner of Abbey Square and Abbey Quay, at a distance of approximately 50m.

Seamus Rafter Bridge Removal

11.10.16 Removal of the Seamus Rafter Bridge will require a crane, trucks to remove the bridge material to recycling plants and for crushing for the concrete. A breaker is likely to be required for the removal of the base structure of the bridge foundations. The nearest NSR is the same as for the construction works for the new footbridge.

Indicative Construction Noise Levels

11.10.17 A list of construction plant likely to be used during the works is given in Table 11.8. Typical noise levels at 10m from the plant are taken from the DEFRA database (ref) and are presented in the table, together with noise levels calculated at greater distances.

Table 11.8 Construction Plant and Typical Noise Levels

Equipment	Power rating / size	Source	Wall and Embankment works	River Excavation Works	Construction of New South Bridge	Construction of Footbridge	Demolish Seamus Rafter Bridge	Noise level dB L_{Aeq} at distance (m)			
								10	20	50	100
Backhoe loader	62 kW / 8t	DEFRA 2.08	X	X				62	54	45	37
Dump truck - driveby max	60 kW / 9t	DEFRA 4.04	X	X				76	68	59	51
Dump truck - idling	60 kW / 9t	DEFRA 4.05	X	X				63	55	46	38
Truck - driveby max	4-axle wagon	DEFRA 2.34	X	X	X	X	X	80	72	63	55
Piling rotary bored	110t / 1.2m dia	DEFRA 3.14			X			84	76	67	59
Piling rig - crawler crane	132 kW / 55t	DEFRA 3.29			X			70	62	53	45
Generator (site cabins)	250 kVA	DEFRA 4.78			X			66	58	49	41
Piling - mini rig	Excavator mounted	Manufacturer				X		81	73	64	56
Breaker - hand held	20 kg / 69 bar	DEFRA 5.03					X	82	74	65	57
Breaker (excavator mounted)	121 kW / 1650 kg breaker	DEFRA 1.09					X	90	82	73	65
Compressor	1t	DEFRA 5.05					X	65	57	48	40

11.10.18 The works that will be closest to the NSRs are the river widening and wall/embankment works. At times there will be less than 20m between the construction plant and the NSR. Even at this close distance, the operations and plant associated with these works are unlikely to exceed the acceptable noise limits.

11.10.19 The construction of the new bridge is at a sufficient distance from the NSRs so that construction noise is likely to be within the acceptable noise limits. However, the construction of the new footbridge and demolition of the Seamus Rafter Bridge in the centre of the town using inherently noisy construction methods such as piling and breaking have the potential to exceed the noise limits.

11.10.20 It is assessed that the construction work for the new footbridge and the demolition of the Seamus Rafter Bridge could potentially lead to a temporary **minor to moderate negative impact** to the area around the western end of the bridge in Abbey Square.

Mitigation Measures

11.10.21 No specific construction noise mitigation are suggested, but Best Practice would suggest that the principles of Best Practicable Means (BPM), as defined in BS 5228, should be applied to all on-site construction activities.

11.10.22 An agreement should be reached between the principal contractors and the local authority before the construction works commence as to suitable construction methodologies to be used. This should include the working hours, construction methods and plant and noise limits and monitoring as appropriate.

11.10.23 It may be necessary to provide screening to significantly noisy activities such as breaking out of the foundations of the Seamus Rafter Bridge and piling for the new footbridge. It is not possible at this stage of the project to specify where this should occur or the form this should take since sufficient details of the methodologies to be used are not available.

11.10.24 Particular attention should be paid to piling and breaking activities since they give rise to the greatest noise emissions. Any requirement to operate percussion piling rigs or breakers outside the standard hours of 07:00 to 19:00 Monday to Friday should be agreed with the local authority beforehand.

11.10.25 In addition, further qualitative mitigation in the form of timely and effective public relations can be applied so that residents in Enniscorthy are kept informed of ongoing and future construction operations. Our experience is that advanced warning of a potential noise, its cause and likely duration can have a significant effect in reducing adverse perception of noise by the local community.

11.11 Potential Environmental Impacts during Operation

IMPACT: Noise during Maintenance of the Proposed Scheme

11.11.1 An outline of the potential maintenance measures required for the proposed flood scheme is given in **Section 3.4**.

11.11.2 There is a limited likelihood of river bed works, as the scheme design is such that only material in the sediment deposition area 1.5km upstream of the works would need to be removed on an irregular basis.

11.11.3 Maintenance activities for the new bridge that may produce noise will include: replacement of joints, cables and hangers; resurfacing and waterproofing of the deck and repainting of steelwork. The bridge will be designed so that the maintenance interval for all of these activities will be at least 15 years.

11.11.4 Although details of the timing, duration and scale of the maintenance works for the scheme have not yet been defined, they would be on a much reduced scale compared to the scheme construction works.

11.11.5 It is therefore assessed that maintenance works associated with the flood alleviation scheme will have a **temporary negligible negative noise impact**.

IMPACT: Traffic Noise as a Result of Changes to the Road Network

11.11.6 The potential noise impacts of the scheme resulting from the changes to the road network associated with the new south bridge were assessed by calculation of the traffic noise for the 'Do Something' scenario for the opening year 2012 and the future year 2027.

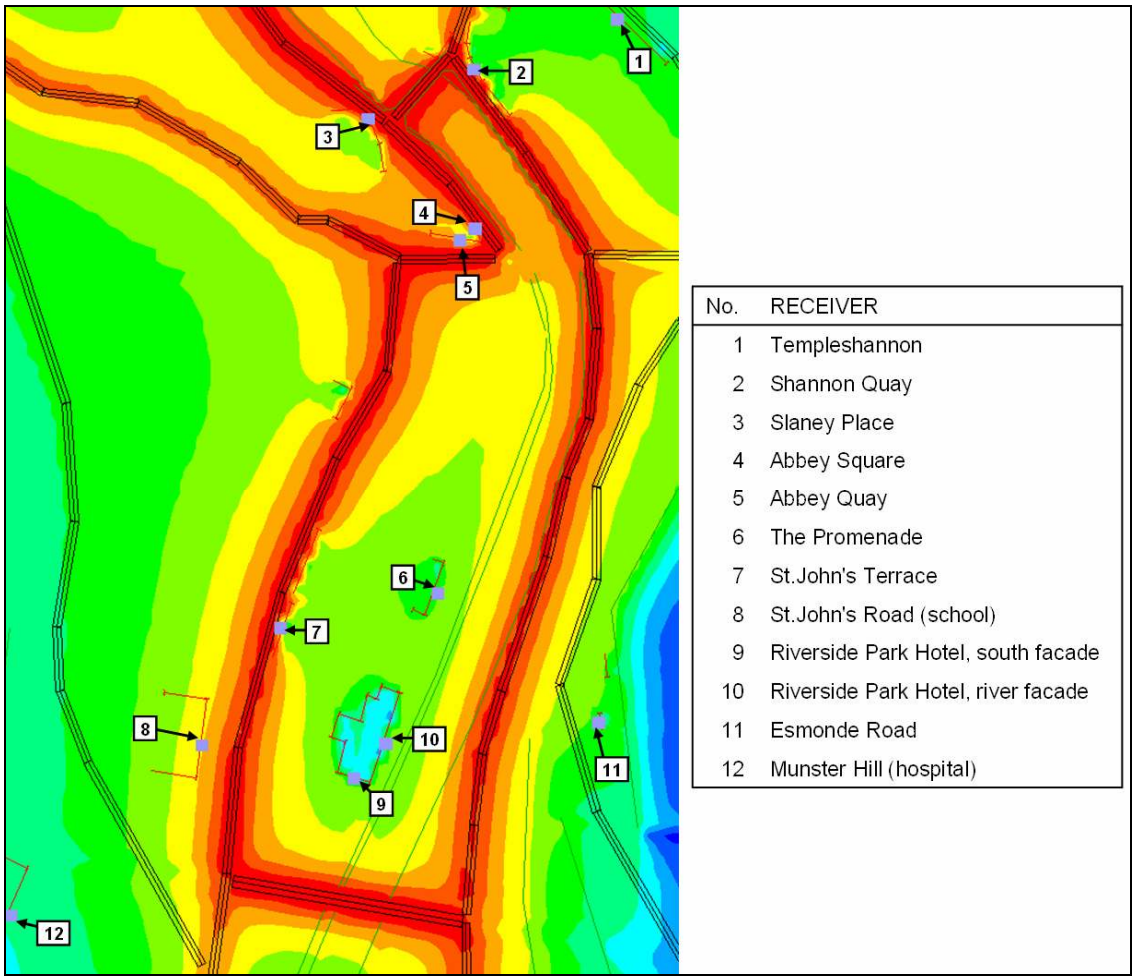
11.11.7 The predicted traffic flows presented in **Table 11.5** were input to the noise model and. The 'Do Something' noise levels for the receptor points are presented in **Table 11.9**. The potential impact magnitude of the scheme is also presented, this being the difference between the 'Do Something' and the 'Do Nothing' noise levels at the receptors points for each of years assessed.

Table 11.9 Traffic Noise Levels for 'Do Something' Scenario

No.	Receiver Point	'Do Something' L_{den} dB noise level		Impact magnitude dB 'Do Something' - 'Do Nothing'	
		2012	2027	2012	2027
1	Templeshannon	61.5	62.4	-0.3	-0.3
2	Shannon Quay	71.6	72.6	0.0	0.0
3	Slaney Place	72.7	73.7	-0.1	-0.1
4	Abbey Square	69.0	69.9	-0.5	-0.5
5	Abbey Quay	71.9	72.7	-0.3	-0.3
6	The Promenade	62.2	63.2	-0.3	-0.3
7	St. John's Terrace	71.3	72.2	0.9	0.9
8	St. John's Road (school)	66.6	67.6	0.9	0.9
9	Riverside Park Hotel, south facade	62.0	62.9	1.5	1.5
10	Riverside Park Hotel, river facade	62.3	63.3	0.2	0.2
11	Esmonde Road	62.1	63.1	0.1	0.1
12	Munster Hill (hospital)	58.4	59.3	0.9	0.9

11.11.8 A noise contour plot of the dB LA10 noise levels for the 2012 'Do Something' scenario is presented in **Figure 11.1** for illustrative purposes, showing the position of the receptor points and the new south bridge.

Figure 11.1 L_{A10} traffic noise contour levels for 2012 'Do Something' scenario



11.11.9 The impact magnitudes of the traffic noise from the scheme are all less than 1dB except for the south façade of the Riverside Park Hotel. An impact magnitude of 1.5dB is predicted for this receptor point for both 2012 and 2027.

11.11.10 Using the impact significance values in **Table 11.2** would assess a noise increase of 1.5 dB to be a negligible impact. However, the NRA guidelines specify that mitigation will be deemed necessary if the following three conditions are met:

- The traffic noise level at the receptor exceeds the design goal of 60 dB L_{den};
- The noise level with the scheme is at least 1 dB more than without the scheme; and
- The contribution from the road scheme is at least 1 dB.

11.11.11 The three conditions are met on the south façade of the Riverside Park Hotel and mitigation of operational traffic noise will be required.

MITIGATION: Operational Traffic Noise

11.11.12 Mitigation of traffic noise from the elevated road on the new bridge to the south of the Riverside Park Hotel could take the form of reducing the source noise, increasing the noise attenuation of the transmission path or treatment at the receiver.

11.11.13 Reducing the source noise directly emitted by individual vehicles passing over the bridge could be achieved by laying a low noise road surface across the bridge, reducing noise emitted from the tyre/road interface. The reduction in traffic noise achieved by a low noise surface would depend on the ratio between the noise from engines and exhausts and that from the tyres. This will be dependant on the speed of the traffic and the gradient of the road across the bridge.

11.11.14 Attenuation of the noise transmitted from the bridge could be achieved using a noise barrier. A barrier or berm close to the hotel is unlikely to be effective due to the height of the road on the bridge. A barrier close to the source could be erected along the northern parapet of the bridge. However, the lower the barrier the less the attenuation achieved, so a barrier along the parapet of the bridge giving sufficient noise reduction may be deemed to be visually intrusive.

11.11.15 Mitigation at the receiver could take the form of insulation of walls and windows on the southern façade of the hotel. The level of insulation required would depend on the uses of the rooms at the southern end of the hotel, bedrooms requiring the most attenuation.

11.11.16 The required mitigation of traffic noise at the southern end of the hotel is less than 1 dB. It is assessed that a combination of the mitigation levels above will reduce the traffic level by at least the required amount, resulting in a **negligible negative impact**.

11.12 Monitoring

11.12.1 No noise monitoring requirements have been identified.

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12 CLIMATE

12.1 Introduction

12.1.1 This section examines the changes in greenhouse gas emissions with and without the proposed scheme.

12.2 Assessment Methodology

12.2.1 There is no specific assessment methodology relative to total greenhouse gas emissions for a scheme, consequently, the methodology for the assessment of significance is that described in **Section 4.6**. The calculations undertaken for the air quality section (Section 10) were used to inform the carbon emission volumes for this section.

12.3 Data Collection

12.3.1 Data was obtained from Met Eireann.

12.4 Surveys

12.4.1 No surveys were undertaken specifically for this proposed scheme or EIS.

12.5 Consultation

12.5.1 No specific consultation was undertaken for this element of the proposed scheme or EIS.

12.6 Baseline Environment

12.6.1 The mean daily temperature in the study area is 9.3°C based on records from 1961 to 1990 at Kilkenny[1]. The mean daily sunshine[1] in the area is 3.51hours, and the annual mean rainfall[1] is 822.8mm, and the mean wind speed[1] is 6.5 knots.

12.7 Do Nothing Scenario

Climate Change

12.7.1 **Table 5.6** presents the percentage increases in road traffic vehicles as predicted by the National Roads Authority. By 2027, the number of vehicles on the road is anticipated to have grown by 14% to 26% for cars, and by 16% and 32% for Heavy Commercial Vehicles. However, the emissions of greenhouse gases from road vehicles is not likely to increase by that amount, due to the increased efficiency of road traffic vehicles as specified by European Directives and encompassed into Irish Law. In total, the growth rate in vehicle emissions is unlikely to make any material difference in the localised area.

12.8 Potential Environmental Impacts

IMPACT: Greenhouse Gas Emissions

12.8.1 **Table 12.1** presents the regional emissions of carbon in tonnes/year, with and without the scheme. The 'without scheme' scenario is the equivalent of the 'do nothing' scenario. The calculations indicate that the scheme would result in higher emissions of carbon (an increase of 7.2%) with the proposed scheme in place in the design year (2027) for the

[1] www.met.ie/climate/kilkenny.asp, July 2006.

road. However, the figures used in the calculations were conservative traffic volumes, as some road traffic users would not follow the additional route length as have been included in the calculations. Furthermore, the figures cannot take into account the number of people who would cycle or walk with the new footbridge over the River Slaney where once the Seamus Rafter Bridge stands. At a local level these changes are potentially minor in scale, but at the county and regional level the emissions are negligible in terms of county levels of carbon emissions from road traffic. Consequently, a **negligible negative impact** is predicted.

Table 12.1 Regional Air Quality Calculations

Year	With / Without Junction Works	C (tonnes/year)
2007	Without	1,637
2012	Without	1,741
	With	1,869
2027	Without	2,073
	With	2,223

12.9 Monitoring

12.9.1 No monitoring is required.

13 THE LANDSCAPE

13.1 Introduction

13.1.1 This section examines the landscape character and visual aspects of the environment with regard to the study area and the proposed scheme.

13.2 Assessment Methodology

13.2.1 There is no specific assessment methodology relative to total greenhouse gas emissions for a scheme, consequently, the methodology for the assessment of significance is that described in **Section 4.6**.

13.3 Data Collection

13.3.1 Landscape designations were obtained from the Wexford County Council Local Development Plan, and the Enniscorthy and Environs Local Development Plan.

13.4 Surveys

13.4.1 A walkover landscape survey was undertaken for the landscape character assessment for the proposed scheme and EIS.

13.5 Consultation

13.5.1 No specific consultation was undertaken for this element of the proposed scheme or EIS.

13.6 Baseline Environment

13.6.1 A landscape assessment was carried out for the study area and is summarised within this section. A full copy of the assessment is included in **Appendix 12**.

Landscape Character

13.6.2 A Landscape Character Area has a distinct and consistent pattern of natural and cultural elements. The study area is divided into two main Landscape Character Areas. Descriptions of these Character Areas are detailed below.

Agricultural Character Area

13.6.3 Most of the Study Area falls within the Agricultural Character Area (see **Plates 3 - 9**, in **Appendix 12**, which show its typical features).

13.6.4 In general, the Agricultural Character Area is characterised by contiguous fields of varying size, which comprise predominantly pasture interspersed with arable cropping. Intermittent trees and fragmented hedgerows bound these fields.

13.6.5 The land is gently undulating in form, sloping to the river valley.

13.6.6 The high ecological status of the river and its immediate environs are reflected in the range of habitats present including wet grassland, small woodlands (comprising both broad-leaved and mixed species), open water and marsh.

13.6.7 There are few residential buildings within this Character Area. The settlement is generally dispersed in nature, with isolated farms and small clusters of houses. Building styles are a mixture of traditional and modern. There are also a number of surfaced roads including the N11, which runs north to south through the study area.

13.6.8 This Character Area is of a high visual quality, remaining largely unmodified by urban development. The landscape is partially enclosed with framed and filtered views to and from the river, which creates a sense of wholeness. Views across the agricultural land are contained by variations in topography and occasional woodlands. Areas of trees, hedgerows and scrub divide the Character Area into a regular framework, creating a patchwork of visual envelopes in which the agricultural activities are set.

Urban Character Area

13.6.9 Enniscorthy town falls within the Urban Character Area. **Plates 15 - 19** and **21** in **Appendix 12** indicate the typical features of this Character Area, which can be summarised as follows:

- Key historical and cultural foci (such as the River Slaney, Castle and Enniscorthy Bridge);
- A mixture of residential, commercial (including former warehouses, such as the Minch Norton buildings) and recreational properties;
- Associated urban infrastructure including street lighting and signs; and
- Transient populations such as walkers, drivers, cyclists and anglers.

13.6.10 The core area of Enniscorthy has a strong identity, being symbolic of the town's historic past. However, some modernisation is evident in the form of shop frontages etc. There are also areas of heavy traffic, notably across the New Bridge and Enniscorthy Bridge, which 'detract' slightly from the aesthetic integrity of the historic core.

13.6.11 While the historic features (such as the Castle and Enniscorthy Bridge) create a visual focus, their perceived fields of visual influence are relatively narrow due to the presence of intervening landform and landscape features (including buildings). For example, the river is not evident from Castle Hill (and vice versa), and trees filter the views of the river from Shannon Quay (and vice versa). Likewise, there are few residential or commercial properties from which views of the river are uninterrupted, for example those within Salthouse Lane and Abbey Quay, and at the Riverside Park Hotel.

13.6.12 The ecological status of the Urban Character Area is moderate, primarily comprising the river, in comparison to the high status noted within the Agricultural Character Area. However, immediately north and south of the town, transitional areas of urban park merge with the Agricultural Character Area.

Landscape Policy

13.6.13 There are a number of issues within the Landscape and Landscape Assessment: Consultation Draft of Guidelines for Planning Authorities (Department of the Environment and Local Government (Ireland), 2000) that are relevant to the study area. These policies are presented in **Table 13.1**.

Table 13.1 Relevant Issues from the Landscape and Landscape Assessment: Consultation Draft of Guidelines for Planning Authorities

Issue
"Landscape is a precious national asset". "There is a growing appreciation of the importance of landscape for development in general, for recreational activity and for tourism". "While it is national policy to respect each landscape as the context in which development takes place, issues of balance will have to be decided locally".

13.6.14 The Wexford County Development Plan (2001a) also states that the "landscape is an important element of the environmental resource base". Within the context of development, the County Council will therefore seek to ensure that the "character giving elements of the landscape resource are conserved".

13.6.15 Specific landscape designations are discussed in the Landscape Sensitivity Assessment.

There are a number of Protected Views within Enniscorthy, and particularly in areas that could be affected by the proposed scheme:

- EV 015: Views of the Junction of Seamus Rafter Bridge and Abbey Square;
- EV 017: Views from the corner of Shannon Quay and Seamus Rafter Bridge;
- EV 018: Views from Shannon Quay looking North West to Enniscorthy Bridge, Shannon Quay along to Seamus Rafter Bridge;
- EV 019: Views of Enniscorthy Bridge and Templeshannon.
- EV 022: View at The Quaker Meeting House looking south East to Vernacular House.

Landscape Values Assessment

13.6.16 The landscape values associated with the study area relate to the benefits, services and functions that are derived. These values are culture, environment and socio-economic related, although each element is interrelated.

Environment Related Values

13.6.17 The Slaney River is a cSAC under the EU Habitats Directive. As detailed in **Section 6**, the middle and lower reaches of the river are designated for a range of habitats (Annex I) and species (Annex II) including floating river vegetation, freshwater pearl mussel and otter. There are also some bird species listed in Annex I of the EU Birds Directive.

Socio-economic Related Values

13.6.18 The whole of the Slaney Valley is designated as being of high amenity (Wexford County Council, 2001a). This designation reflects the economic, recreational amenity and educational benefits of the area. The Promenade, south from the Seamus Rafter Bridge, is particularly popular for informal recreation.

13.6.19 The Riverside Park Hotel, situated on the Promenade, attracts tourists visiting Enniscorthy and its surroundings.

13.6.20 Slaney Drive North and South are scenic routes, from which views of the Slaney Valley can be enjoyed. However, the river is not continuously visible from these roads.

Cultural Related Values

13.6.21 Culture related values, with respect to specific buildings and historical events/links, are strong particularly within the historic 'core' of Enniscorthy. These values are detailed below:

- Vinegar Hill, east of Enniscorthy, is associated with the Irish Rebellion of 1798 in County Wexford (the largest uprising in Irish history). There is a National 1798 Visitor Centre in Mill Park Road;
- The Slaney was historically a busy waterway, transporting various goods;
- Enniscorthy Bridge, over the Slaney, which dates from 1630 (modified in 1837);
- The Norman castle, which is now a museum and tourist information centre;
- Seamus Rafter, who launched the Gaelic League in Enniscorthy. His memorial is situated in Abbey Square, with the new bridge also named in his honour;
- The Annual Strawberry Fair in July. Enniscorthy and its environs are at the heart of the soft fruit growing industry;
- The Blackstairs Blues Festival in September, which takes place throughout Enniscorthy;
- The crafts industry, particularly the pottery industry; and
- The Marconi connection. Jameson's Whisky distillery was once based a mile outside Enniscorthy, and Annie Jameson was the mother of Guglielmo Marconi, the radio pioneer.

Summary of Values

13.6.22 **Table 13.2** summarises the values placed on landscape/visual resources in the study area.

Table 13.2 Landscape/Visual Resources and their Values

Resources	Values
Farmland	Socio-economic, rural image
Urban centre (Enniscorthy)	Socio-economic, identity, historical and cultural image
Housing (urban)	Social habitation
Roads	Socio-economic interconnection
Industrial zone (urban)	Economic
River valley	Economic (fisheries), recreation, wildlife/biodiversity, scenery, remoteness and tranquillity

Landscape Sensitivity Assessment

13.6.23 The sensitivity of a landscape is the measure of its ability to accommodate change without it suffering unacceptable/detrimental loss or alteration. This aspect is evaluated principally in relation to landscape values and in turn, is related to the type and scale of the proposed developments. Key criteria to consider are:

- Importance (low – high, and local - international);
- Sufficiency (vulnerability); and
- Substitutability.

Vulnerable Areas

13.6.24 Areas that are designated as vulnerable have the highest scenic quality with limited potential to absorb intensive development (Wexford County Council, 2001a). Designated vulnerable areas, which are relevant to the Study Area, include the riverbanks and the skylines of upland areas (Wexford County Council, 2001a).

13.6.25 The Wexford County Development Plan (Wexford County Council, 2001a) states that "*to be considered for permission, development in the vicinity of these vulnerable areas must be shown not to impinge in any significant way upon their character, integrity or uniformity when viewed from the surroundings*".

Sensitive Areas

13.6.26 Sensitive areas have a homogeneous character with associated high scenic amenity. Sensitive areas within the Study Area include natural grassland, transitional woodland scrub, broad-leaved forest, mixed forest, the river itself and other water courses/bodies (Wexford County Council, 2001a). The areas north and northwest of Enniscorthy and south along the River Slaney corridor are designated as sensitive.

13.6.27 The Wexford County Development Plan (Wexford County Council, 2001a) states that "*applications for development must demonstrate an awareness of these inherent limitations by having a very high standard of site selection, site layout, selection of materials and finishes*". In particular, importance is placed on the maintenance and conservation of features of the local landscape such as trees, woodlands, hedgerows, watercourses, walls and gates.

Normal Areas

13.6.28 Areas designated as normal include pastureland, coniferous plantations and complex cultivation patterns. These areas have the potential to absorb a wide range of new developments subject to planning, design and environmental policies, criteria and procedures. The Wexford County Development Plan (Wexford County Council, 2001a) states that "*the County Council will seek to ensure that the rural qualities of these areas are protected and that landscape features including trees, woodlands, hedgerows and walls are conserved*".

Robust Areas

13.6.29 In contrast, a number of areas are designated as being robust within the Wexford County Development Plan (Wexford County Council, 2001a) for example continuous and discontinuous urban fabric, industrial/commercial units, road and rail networks, and sports and leisure facilities. This category relates to areas of existing concentrated development and infrastructure contained in towns and villages. These areas also have the potential to absorb new developments subject to compliance with planning, design and environmental policies, criteria and procedures. However, particular consideration should be given to the character of the area through undertaking careful design and using appropriate materials.

13.6.30 In general, the vulnerable and sensitive areas are more sensitive (being least substitutable) and hence, more restrictive (less flexible) of change in comparison to the normal and robust areas.

13.7 Do Nothing Scenario

Riverside Landscape Character

13.7.1 No negative or positive change is currently envisaged in the riverine landscape character in the long term.

Floodplain Landscape Character

13.7.2 No negative or positive change is currently envisaged in the floodplain landscape character in the long term.

13.8 Potential Environmental Impacts

IMPACT: Obstruction to Views

13.8.1 Enniscorthy has a number of visual receptors that are sensitive to landscape change, including designated tourist routes and viewpoints, roads, bridges and residences / hotels, etc. Installation of flood walls, embankments, the removal of Seamus Rafter Bridge, the new footbridge and the new road bridge would inevitably impact upon these receptors, obstructing views across the river, as well as of the opposite side of the river. The heights of the permanent walls are 1.2m above the road levels or raised road level, which would maintain most amenity views from footpaths, but could result in the obstruction of ground floor views along Shannon Quay and Abbey Quay. However, the majority of these are commercial properties and particularly along Shannon Quay, the views out of the ground floors are already obscured by internal shop fittings, curtains, or obscured windows. Consequently, for the most, there is limited obstruction to views, with the exception of the Promenade in the area of the Riverside Park Hotel, and also from within the Riverside Park Hotel (southern views), the new road bridge would result in obstruction to the views southward along the river (see **Figure 13.1**).

13.8.2 Overall, the number of views obstructed is small, and predominantly affecting commercial premises whose location and views are not a criteria necessary for their commercial success, with the exception of the Riverside Park Hotel. Overall, the only key obstruction to views is that along the Promenade in the area of the Riverside Park Hotel, as well as views from the Riverside Park Hotel. However, given the distance to the bridge and the limited obstruction, a **minor negative impact** is anticipated.

Figure 13.1 Photomontage Showing New Bridge from Left Bank Upstream Opposite the Riverside Park Hotel

IMPACT: Alteration to Riverside Landscape Character

13.8.3 Enniscorthy has a number of visual receptors that are sensitive to landscape change, including designated tourist routes and viewpoints, roads, bridges and residences / hotels, etc. Installation of flood walls, embankments, the removal of Seamus Rafter Bridge, the new footbridge and the new road bridge would inevitably impact upon these receptors by altering the character of the views. These could result in significant alterations to the character within the area, which is an area that is considered sensitive to landscape change, as a result of its scenic urban and rural river views. Consequently, the sensitivity of the area is high.

13.8.4 The magnitude of the scheme is predominantly low to medium depending on the location between the Promenade downstream of the Riverside Park Hotel and Island Road upstream of Enniscorthy Bridge. The scheme consists of flood walls, which retains a similar characteristic to the existing riverside walls, whilst downstream of the Riverside Park Hotel the scheme would also include a combination of wall and embankment, which would co-exist with the mixed grass and tarmac character of the promenade and the adjacent walls of the Riverside Park Hotel.

13.8.5 The road raising to ensure that wall raising does not significantly obstruct views within the area (as described in **paragraphs 13.8.1** and **13.8.2**) occurs in existing paved and tarmaced areas, thereby not resulting in any significant change in character.

13.8.6 Widening will change the view for particular areas such as along Promenade Road, Abbey Quay, and views from Enniscorthy Bridge northward toward the meadow. However, in terms of the character of these sites, the change will be in view but not character as the soft river edges would be retained but in a different location, whilst existing walls would be set back where the river is widened.

13.8.7 The removal of Seamus Rafter Bridge will open up the character of the river in this location, though the placement of the footbridge would again close in the views, however, the footbridge would be of much 'lighter' construction, providing greater view of the river and through the bridge itself.

13.8.8 View EV 015 (see **Figure 13.2**): the junction of Seamus Rafter Bridge and Abbey Square would not be significantly affected, except there would be a slightly lower volume of traffic, and the Seamus Rafter Bridge would be removed. The road raising would not disrupt the viewing elements, and wall raising would encompass local stone cladding which would tie the works in to the existing stone features in this area. Effect: positive element of change with removal of Seamus Rafter Bridge, no character change, minor obstruction to views from commercial property.

Figure 13.2 View Toward Seamus Rafter Bridge and Abbey Quay

13.8.9 View EV 017 (see **Figure 13.3**): views from the corner of Shannon Quay and Seamus Rafter Bridge would see a much raised river wall along Shannon Quay, however, with the ground raising this will not be incongruous and would not significantly alter the character. The same would occur along the Abbey Quay wall from this viewpoint, as the walls would be the same however, they would be raised higher. However, the raised ground in this viewing area will also ensure clear views with little change to the character.

13.8.10 View EV 018 (see **Figures 13.3** and **13.4**): views from Shannon Quay looking north west to Enniscorthy Bridge, and along Shannon Quay to Seamus Rafter Bridge will in part show limited change in character, but certain elements may be visible. The river narrowing on the left bank immediately downstream of Enniscorthy Bridge would be built into the river up to the end of the first bridge eye. The use of local stone facing, along with ground raising, should minimise the alteration to the character of the area. The ground raising elements along Shannon Quay would be followed by a 1.2m high wall on the edge of the river, but soft landscaping in the form of grass planting would retain the softer character along Shannon Quay. Whilst the removal of Seamus Rafter Bridge would provide a positive softening of views.

Figure 13.3 View from the Corner of Seamus Rafter Bridge and Shannon Quay

Figure 13.4 View Along Shannon Quay to Seamus Rafter Bridge

13.8.11 EV 019 (see **Figures 13.5, 13.6** and **13.7**): the views of Enniscorthy Bridge and Templeshannon would change in character. Although no significant works are expected to Enniscorthy Bridge the river narrowing work would narrow the river corridor and views through the bridge, though not significantly affecting its character, nor are they of a particularly significant scale. The views of Templeshannon would not be changed in character, though along Shannon Quay, the ground raising and wall would remove the softer edging of the grass, but retain the trees. Overall, a minor hardening of the character of the area is expected.

Figure 13.5 View of Enniscorthy Bridge and Templeshannon

13.8.12 The new road bridge downstream of the Riverside Park Hotel will cause a change to the character of a localised area, as the current natural character would be overshadowed by the hard, harsh angles and straight lines of the bridge. However, the varied cable-stays produces a softening affect to the structure from a distance (see **Figure 13.8**).

13.8.13 Overall, there would be no significant changes to the riverside landscape character, though there would be some changes, some that are negative though some aspects are positive (the removal of Seamus Rafter Bridge), whilst other elements reinforce the character of the area. Overall, with the generally localised adverse changes to character, a **minor negative impact** is anticipated.

Figure 13.6 View of Enniscorthy Bridge and Templeshannon

Figure 13.7 View of Shannon Quay from Enniscorthy Bridge

Figure 13.8 View of New Bridge from the South

IMPACT: Alteration to Floodplain Landscape Character

13.8.14 The proposed scheme will retain flood water within the river as bounded by the containment walls or by higher ground surrounding the floodplains. The scheme would not result in an increase or decrease in the floodplain inundation, so there would be no change to the character of the floodplain.

13.8.15 The flood flow deflectors on the floodplain will cause obstruction to some views from Island Road (see **Figure 13.9**). Other than reduced flooding on the top of the deflectors, they would retain the same character due to the re-colonisation by vegetation. Given the area would flood only a few days in a hundred years; consequently, a **minor negative impact** is anticipated on floodplain character.

13.9 Monitoring

13.9.1 No monitoring is required.

Figure 13.9 View of Meadows from Ireland Road upstream of the Railway Bridge

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14 MATERIAL ASSETS

14.1 Introduction

14.1.1 This section examines the material assets present within the study area, and the potential consequences of the proposed scheme on them during construction and operation.

14.2 Assessment Methodology

14.2.1 There is no specific assessment methodology relating to total greenhouse gas emissions for a scheme, consequently, the methodology for the assessment of significance is that described in **Section 4.6**.

14.3 Data Collection

14.3.1 The data was predominantly collected from the Wexford County Council Local Development Plan and the Enniscorthy and Environs Local Development Plan.

14.4 Surveys

14.4.1 No specific surveys were undertaken to inform the EIA process for material assets.

14.5 Consultation

14.5.1 No specific consultation was undertaken for this element of the proposed scheme or EIS.

14.6 Baseline Environment

Infrastructure

14.6.1 Enniscorthy town is situated in a central position in the county, on the River Slaney. It is 20km north-west of Wexford town and approximately 116km from Dublin and 29km from Gorey. Enniscorthy is accessed by the following main roads:

- N11 National Primary Route (also referred to as Euro route E01) approximately 116km from Dublin;
- N30 National Primary Route to Waterford;
- N80 National Secondary Road to Carlow;
- R702 Regional Route to Kilkenny; and
- R744 Regional Route to Blackwater and the coast.

14.6.2 Enniscorthy is bisected by the N11. There is also a rail link that services the town and follows the river through the town, along its west bank, as far as Wexford. In several places, the rail line is within the floodplain.

14.6.3 There are three bridges that cross the River Slaney within Enniscorthy itself and they provide access for road traffic vehicles, pedestrians and cyclists. The three bridges are the Railway Bridge at the upstream end of the town, the Enniscorthy Bridge (also called the Old Bridge), and Seamus Rafter Bridge toward the downstream end. Due to the head clearance, Seamus Rafter Bridge constricts any navigation of the river. The Seamus Rafter Bridge and the Railway Bridge are late 20th Century constructions, whilst the

Enniscorthy Bridge is a historic Protected Structure. The structural stability of the bridges is unknown.

14.6.4 A sewer runs along Promenade Road for the majority of its length. Detailed information for other services for the whole study area is not available due to level of design available at this stage.

14.6.5 A number of surface water drainage outfalls are located along the river within Enniscorthy. The sites of specific drains and outfalls are not confirmed at this stage.

14.7 Do Nothing Scenario

Bridges

14.7.1 As no structural survey has been carried out of the bridges, consequently, the risk of instability or collapse as a result of a significant flood event combining high water levels and high flows cannot be determined, but must therefore currently be a considered risk.

14.8 Potential Environmental Impacts during Construction

IMPACT: Disturbance to Road Network Infrastructure

14.8.1 The materials and construction equipment required for the proposed works would not exceed standard heavy goods vehicle weights. Current HGV traffic along the roads likely to be used by construction traffic is in excess of 1000 vehicles per day (see **Section 5.6**). Consequently, the handful of movements expected each day on the national road network during construction would not exceed 1%, and as HGV volumes fall below the threshold identified in the NRA guidelines on the assessment of road impact no noticeable obstruction or delay to traffic would be expected during the construction period. Consequently, **no impact** is expected.

14.8.2 Some works would be undertaken to national roads, in particular the road raising and the tie-in works for the new bridge described in Section 3, that are required as part of the proposed scheme. The detailed design stage will identify the specific road surface details, prior to construction, and these would be agreed with the National Roads Authority and the County Roads Section prior to contract letting. Consequently, these works would also not affect the surrounding road infrastructure, and **no impact** would occur.

IMPACT: Disturbance to Bridges

14.8.3 Underpinning works would be undertaken as part of the river bed re-grading work. The detail design and methodology are not known at this stage, consequently, potential effects cannot be determined. However, in the detailed design stage, the methodology and materials to be used in these works will be agreed with the National Roads Authority, Iarnrod Eireann and Wexford County Council prior to the commencement of construction, to ensure that no stability or structural disturbance occurs. Initial stages of the detailed design should include a structural survey of both bridges (the Railway Bridge and Enniscorthy Bridge) to inform the design. In the event that temporary closure is required, measures should be identified and agreed that minimise disruption. For example, the timing of the works could be targeted at providing temporary redirection of traffic to use the new bridge and Seamus Rafter Bridge during works under the Enniscorthy Bridge. Subsequently, the Seamus Rafter Bridge dismantling can then take place.

14.8.4 Provided sufficient consultation, liaison and agreement are confirmed with the parties mentioned above, **no impact** should occur in relation to bridges and their structures.

IMPACT: Disturbance to Rail Network

14.8.5 Underpinning works of the Railway Bridge would be undertaken as part of the river bed re-grading work. Detailed design and construction methodology are not known at this stage, consequently, it is unknown whether any temporary suspension of use may be required. Consequently, during the detailed design phase discussion and agreement with the Iarnrod Eireann regarding the method and materials, as well as timing of the works in the event of likely temporary suspension of use should be undertaken.

14.8.6 The proposed new bridge will cross the existing rail line toward the southern end of Enniscorthy. The initial design seeks to avoid any disturbance or disruption to the rail network infrastructure. However, during detailed design of the bridge and bridge construction method, agreement must be received with Iarnrod Eireann regarding the proposed works method and design. In addition, this consultation and agreement should also include the works programme and procedures and agreement over temporary suspension of use during key stages of the bridge works that would need to be undertaken as a result of health and safety requirements.

14.8.7 Provided sufficient consultation, liaison and finally agreement are undertaken with Iarnrod Eireann, **no impact** should occur in relation to the rail network.

IMPACT: Services

14.8.8 During the river widening works downstream of Seamus Rafter Bridge, along Promenade Road, the sewer would need to be moved. This stretch of the sewer is alongside the length of road that would be raised. Detailed design and contract for construction are not available at this stage. Consequently, during detailed design and contract description, consultation and agreement will be undertaken with Wexford County Council and the National Roads Authority with regard to moving the sewer. It is expected that moving of the sewers and the road raising would be undertaken in order to reduce cost, time and disturbance.

14.8.9 During detailed design, a complete map of the services along areas of actual disturbance and excavation will be identified, and if further services may be affected, the detailed design stage will include consultation and agreement with the relevant authorities and companies in order to undertake service re-location. However, given the limited disturbance outwith the riverside areas, it is unlikely that services will be of a level to result in any significant disturbance.

14.8.10 Provided sufficient consultation, liaison and finally agreement are undertaken with Wexford County Council, the National Roads Authority, and other relevant authorities and companies as necessary, a temporary and short-term **negligible negative impact** is expected to occur in relation services.

IMPACT: Drainage and Outfalls

14.8.11 During river widening works alongside Promenade Road, Abbey Quay, Shannon Quay and the N11 alongside the left bank of the river between the Railway Bridge and downstream of Seamus Rafter Bridge, the surface water drainage and outfalls could be affected. The drainage system and outfalls will be confirmed during the detailed design stage, to ensure that the design of new drains, outfalls, and the pumping system to be incorporated as part of the scheme will not be disrupted during the construction works. As well as the timing of the works (to avoid periods of high intensity rainfall), the programme of works would be designed and agreed with Enniscorthy Town Council, Wexford County Council, and the

National Roads Authority. At the same time, all parties will be consulted to agree the detailed design of the new drainage requirements.

14.8.12 Provided sufficient consultation, liaison and finally agreement is undertaken with Enniscorthy Town Council, Wexford County Council, and the National Roads Authority, with respect to the surface water drainage, **no impact** should occur in relation to the drainage network.

IMPACT: Flood Risk

14.8.13 Potential river works and flood containment wall works have the potential to affect the capacity and response of the river during any flood flows during construction. The initial design targets a method whereby the works would commence at the downstream end of the town, and work their way upriver to prevent any possibility of increased flood risk or increased flood water levels as a result of the scheme construction. These details will be confirmed during the detailed design stage.

14.8.14 In addition, the in-river works also have the potential to reduce the flow capacity of the river. As the in-river works are identified as taking place during the summer period where there is a lower risk of extreme flood events, during the detailed design stage, specific measures and actions will be identified and form part of the works contract, which would ensure that no increase in flood risk occurs, for example, as a result of blockage by equipment or materials.

14.8.15 Provided detailed design identifies appropriate timing, method and flood risk reduction measures within the works contract, **no impact** is expected with regard to flood risk.

14.9 Potential Environmental Impacts during Operation

IMPACT: Surface Water Drainage

14.9.1 The scheme will provide the provision of pumps to be available for use in the event of surface water drainage blockage during extreme flood events when the level of water within the Slaney results in prevention of surface water discharge. This should be prevent exacerbation of flooding that has occurred in the past, and consequently, although of low frequency, and local scale, the sensitivity of the assets at risk indicates that this would result in a **moderate positive impact**.

IMPACT: Flood Protection to Material Assets

14.9.2 The scheme will provide flood protection to flood events up to 100 Year event. As well as the most extreme flood event, the scheme will also prevent flooding for events of a lower level, and bearing in mind the current standard of defence within Enniscorthy is calculated at around 15 Year event standard, the prevention of flooding to up 180 residential and commercial properties, the prevention of the N11 and other local roads would represent a **major positive impact**.

14.10 Monitoring

14.10.1 No monitoring is required.

15 CULTURAL HERITAGE

15.1 Introduction

15.1.1 This section examines the cultural heritage assets present within the study area, and the potential consequences of the proposed scheme on them during construction and operation.

15.2 Assessment Methodology

15.2.1 There is no specific assessment methodology relative to total greenhouse gas emissions for a scheme, consequently, the methodology for the assessment of significance is that described in **Section 4.6**.

15.3 Data Collection

15.3.1 The data was collected from the Wexford County Council Local Development Plan, the Enniscorthy and Environs Local Development Plan, and available borehole records for Abbey Quay, Abbey Road, Seamus Rafter Bridge, the Garage along Promenade Road, Shannon Quay, and archaeological evaluation trenches at the Leisure Centre.

15.4 Surveys

15.4.1 No specific surveys were undertaken for cultural heritage aspects at this stage of the EIA process.

15.5 Consultation

15.5.1 Consultation was carried out with Dúchas (The Heritage Service) to determine the potential issues that could arise in the study area.

15.6 Baseline Environment

15.6.1 The town of Enniscorthy, with its two bridges, developed around the castle which dates from 1205. The castle was captured by insurgents in 1798 and to mark this event a bronze memorial was put up in the Market Square bearing the simple inscription "1798". The 1798 Centre, near the river, tells the story of the rebellion in County Wexford and surrounding counties.

15.6.2 A total of 23 Recorded Monuments have been identified within approximately 1km of the study area (Duchas, *pers comm.*, 2003) and are listed in **Table 15.1** and presented on **Figure 15.1**. In the County Development Plan (Wexford County Council, 2001a), a further 5 structures within 1km of the study area are listed as Protected Structures (refer to **Table 15.2** and **Figure 15.1**). Protected Structures are designated at the discretion of the Local Authority. Within the Enniscorthy Town and Environs Development Plan (Wexford County Council, 2001b), a total of 109 Protected Structures are listed; of these 4 are considered of National Importance (refer to **Table 15.3** and **Figure 15.2**), 43 of Regional Importance and the remaining 62 of Local Importance. A full list of the Protected Structures appears in **Appendix 13**.

Figure 15.1 National Monuments and Protected Structures within the Study Area

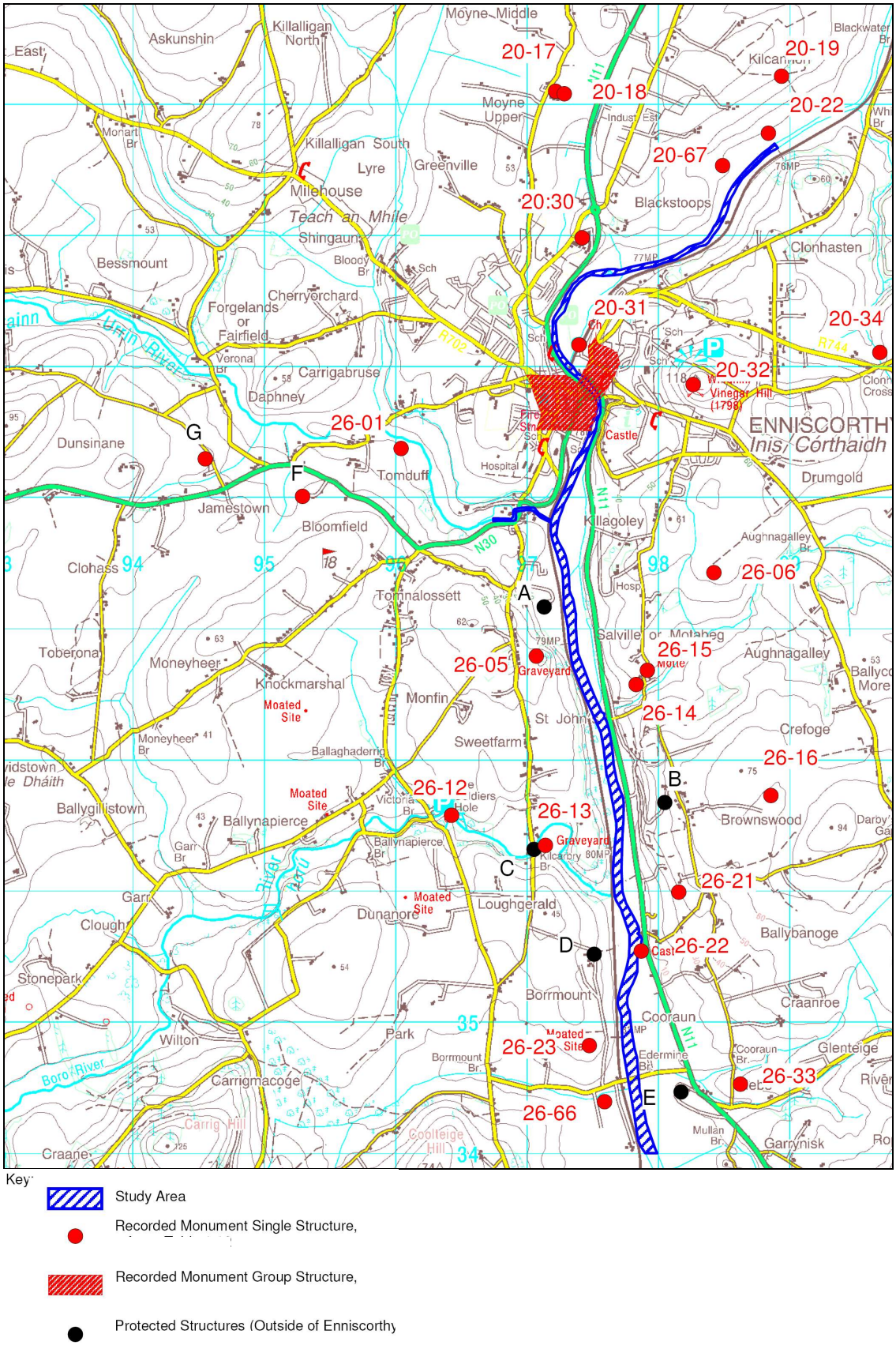
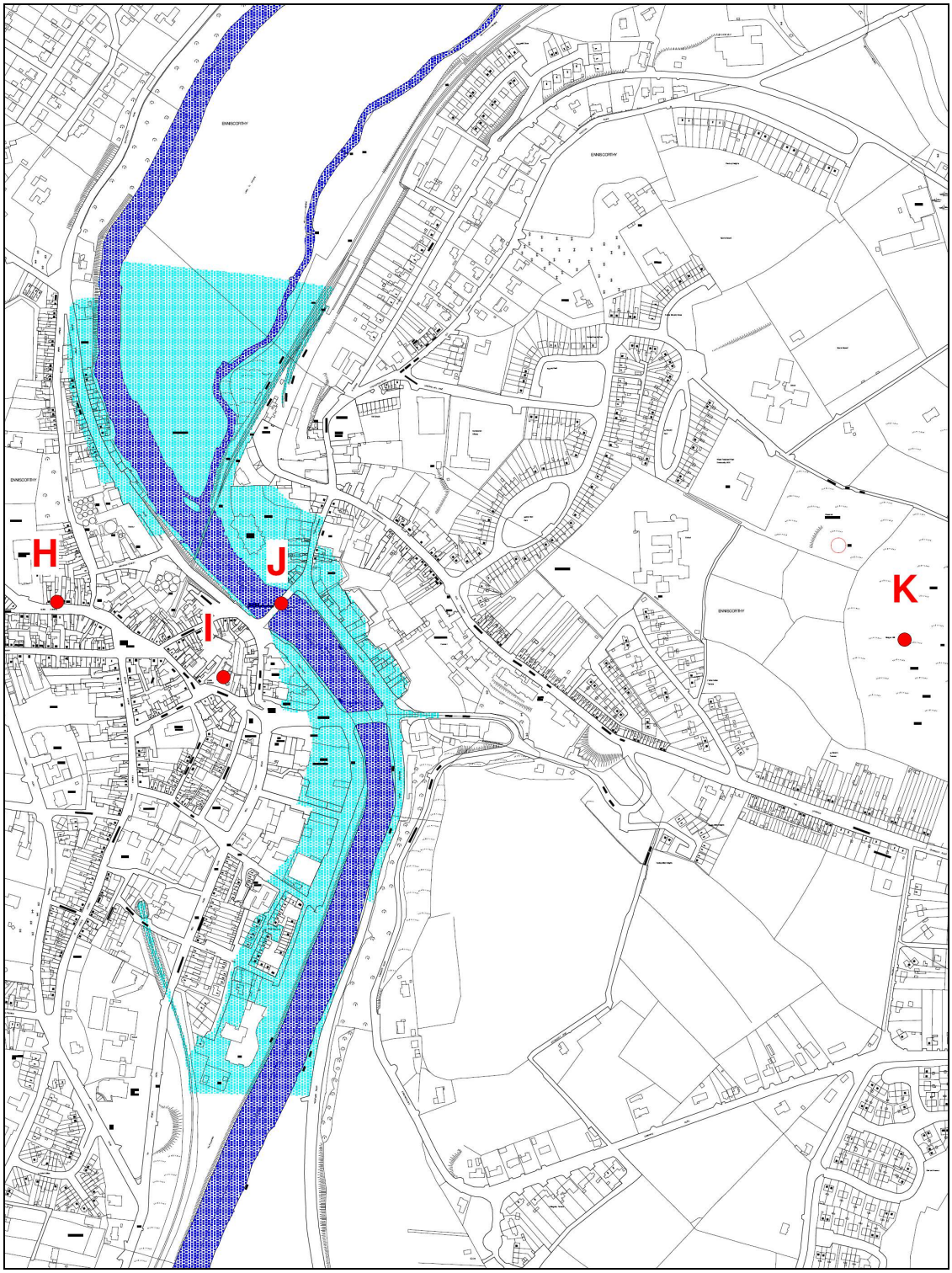


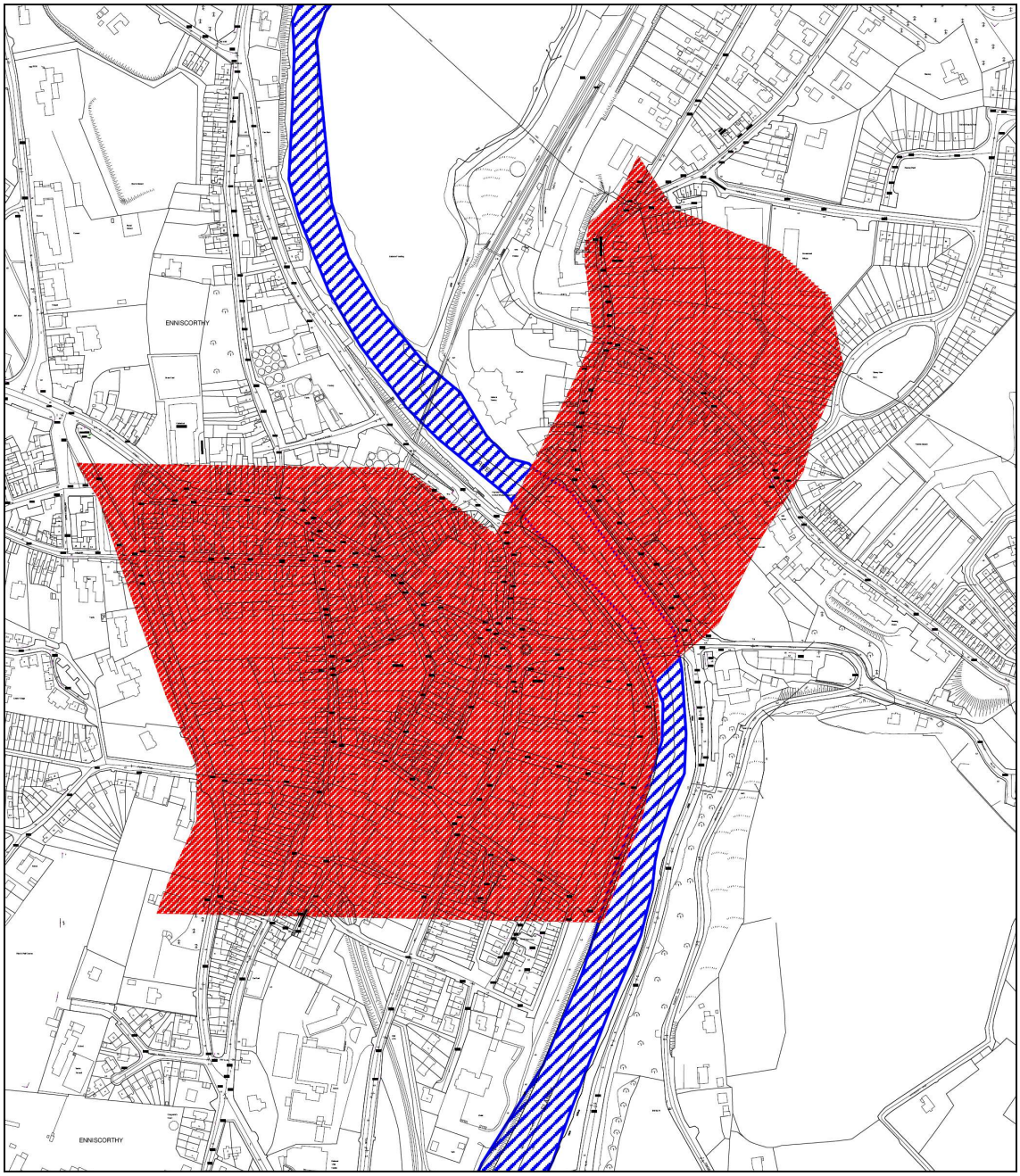
Figure 15.2 Protected Structures of National Interest within Enniscorthy



Key:

● Protected Structures (within Enniscorthy Town,

Figure 15.3 Enniscorthy / Templeshannon Recorded Monuments



Key:

Enniscorthy/Templeshannon
Recorded Monument boundary

Table 15.1 Recorded Monuments within the Study Area

Site No.	Grid Ref.	Townland	Classification
20-17	297390 142010	Moyne Upper	Moated Site
20-18	297420 141950	Moyne Upper	Enclosure Site
20-19	299130 142200	Kilcannon	Pit Alignment
20-22	298950 141770	Kilcannon	Enclosure Site
20-25	299970 141820	Ballynabarny	Enclosure Site
20-30	297400 140980	Enniscorthy	Cist
20-31	297550 139700	Enniscorthy/Templeshannon	Town
20-32	298350 139890	Templeshannon	Windmill
20-34	299780 140170	Tomnafunshoge	Earthwork Site
20-67	298490 141540	Blackstoops	Enclosure Site
26-01	295960 139120	Tomduff	Earthwork Site
26-05	297060 137820	St. Johns	Church Site
26-06	298410 138420	Drumgold	Earthwork Site
26-12	296370 136570	Dunanore	Ringwork
26-13	297190 136380	Kilcarbry	Church Site
26-14	297860 137500	Salville or Motabeg	Boulder Burial (Possible)
26-15	297920 137710	Salville or Motabeg	Motte
26-16	298920 136670	Brownswood	Enclosure Site
26-21	298110 136060	Brownswood	Fulacht Fiadh Site
26-22	297870 135570	Brownswood	Tower House
26:23	297470 134850	Borrmount	Moated Site
26:33	298540 134560	Glebe, Edermine Road	Church Site
26:66	297650 134450	Kilgibbon	Enclosure Site

Table 15.2 Protected Structures Listed in the Wexford County Development Plan

Site	Grid Ref.	Townland	Classification
A	297100 138300	St. Johns	Country House
B	298100 136600	Brownswood	Country House
C	297100 136300	Kilcarbry	Bridge
D	297500 135600	Borrmount	Country House
E	298200 134400	Edermine	Mausoleum
F	295300 139000	Bloomfield	Country House
G	294500 139300	Templescoby (Jamestown)	Church, House and School

Table 15.3 Protected Structures of National Importance Listed within the Enniscorthy Town and Environs Development Plan

Site	Grid Ref.	Classification
H	297200 139800	Shopfront, Upper Façade and Doorcase
I	297300 139800	Castle
J	297400 139700	Bridge
K	298300 139900	Windmill Tower

15.7 Do Nothing Scenario

Flooding of Historic Monuments and Settlements

15.7.1 The area of recorded monuments titled Enniscorthy / Templeshannon is likely to be flooded about three times in the next 50 years (OPW, 2004). Flooding would be expected to last for up to 2 days. However, complete drying out of properties would take much longer. This flooding could affect buildings structurally, particularly for properties in Templeshannon, thereby causing deterioration in the quality of the historic features.

15.7.2 Approximately 20 properties may be affected in the Templeshannon area. This is a small number when compared to the overall number of monuments identified within Enniscorthy; however, the flooding depth may exceed 1m to 2m depending on the flood event.

15.7.3 Continued high flow and high water level flood events could potential affect the stability of the recorded monument of Enniscorthy Bridge in the long term. Without detailed structural survey the current stability is not known.

15.8 Potential Environmental Impacts during Construction

IMPACT: Disturbance to Recorded Monuments and Protected Structures

15.8.1 There are a variety of works proposed as part of the scheme that could result in the disturbance to known areas or structures of historical and archaeological importance, these are:

- River widening along Promenade Road could expose archaeological horizons due to the depth of excavation (c. 3m to 4m) across a width of 8m and length of 400m. Part of this widening is within the Enniscorthy Town Recorded Monument boundary;
- River widening along the northern third of Abbey Quay could expose earlier quay structures or other archaeological horizons due to the depth of excavation (c. 3m to 4m) across a width of 4m and length of 45m. All of this area lies within the Enniscorthy Town Recorded Monument boundary;
- The tie in of the flood containment wall along Abbey Quay could potentially disturb the facing of a small area of Enniscorthy Bridge, which is a Protected Structure. However, it appears that the tie in may well be below ground level and hence no physical disturbance would occur to the bridge's structure. This would need to be confirmed in the Detailed Design Phase;
- River widening along the west bank upstream of Enniscorthy Bridge could expose archaeological horizons due to the depth of excavation (c. 3m to 4m) across a width

of 2m and length of 100+m. However, only a very limited stretch of this area lies within the Enniscorthy Town Recorded Monument boundary;

- River widening works along the east bank between the Railway Bridge and Enniscorthy Bridge combines excavation with the tie in of the flood wall to the side of Enniscorthy Bridge, as shown on **Figure 3.13**. The bridge is a Protected Structure and any significant disturbance must be warranted. However, during the Detailed Design Phase consultation with the Department of Environment, Heritage and Local Government and Wexford County Council will ensure that the disturbance to the bridge structure and facing would be minimised by this work.

15.8.2 Consultation suggests that there is the possibility that historic structures could have survived from a bridge dating back to 1581. Consequently, the above works and their disturbance to potential archaeological horizons within the Enniscorthy Town Recorded Monument, and possible disturbance to the material of the Enniscorthy Bridge Protected Structure, could, using the criteria designed within **Table 4.6** result in a **potential major negative impact**. The sensitivity of the receptors is considered high/regional in value, and the magnitude of the effects is potentially medium, due to the extent of disturbance.

Mitigation Measures

15.8.3 During the Detailed Design Phase and prior to construction, trial pits should be dug along the line of the river widening locations to identify whether any archaeological features or finds or preservational horizons are present, and hence evaluate the significance of potential impacts, if any. The number of trial pits shall be agreed with the Department of Environment, Heritage and Local Government prior to commencement of the evaluation works. The works should be carried out by a suitably qualified and licensed archaeological contractor. If structures or archaeological horizons are recorded, following discussion with the Department of Environment, Heritage and Local Government, excavation and recording may be specified. If no features or archaeological horizons are identified during trial pits, a watching brief should be carried out during river widening works.

Residual Impact

15.8.4 Provided appropriate levels of recording are carried out, based on the trial evaluations, and in line with the requirements of the Department of Environment, Heritage and Local Government, all archaeological material would be recorded and its historic context publicly available. Recording can never retain all information held within archaeological horizons or deposits; consequently, **a minor negative residual impact** would remain.

IMPACT: Disturbance to Unknown Archaeological Sites

15.8.5 There is a potential for unknown archaeological sites or finds to be preserved within large stretches of the river which are being widened upstream of the Railway Bridge, due to the extensive width of widening. This will take place along a river stretch of around 800m, and as such has a high magnitude of disturbance due to the extent, though it is outside any area of high potential for archaeological finds. Unknown finds or features could extend as far back as the prehistoric periods, and the significance would be dependent on the feature or finds. Consequently, a **potential moderate negative impact** could arise due to the risk of such finds or features being disturbed.

Mitigation Measures

15.8.6 During the Detailed Design Phase and prior to construction, trial pits should be dug along the line of the river widening to identify whether any archaeological features or finds or preservational horizons are present, and hence evaluate the significance of potential impacts, if any. The number of trial pits shall be agreed with the Department of Environment, Heritage and Local Government prior to commencement of the evaluation works. The works should be carried out by a suitably qualified and licensed archaeological contractor. The findings of the trial evaluations should be discussed with the Department of Environment, Heritage and Local Government, in order to determine whether any specific excavation work is required, or whether a watching brief is all that is necessary for the construction phase.

Residual Impact

15.8.7 Provided appropriate watching brief or level of excavation and recording are carried out, based on the trial evaluations, and in line with the requirements of the Department of Environment, Heritage and Local Government, all archaeological material within the footprint of the disturbance works would be recorded and its historic context publicly available. Recording can never retain all information held within archaeological horizons or deposits; consequently, **a minor negative residual impact** would remain.

15.9 Potential Environmental Impacts during Operation

15.9.1 **No impacts** are identified for the operational phase.

15.10 Monitoring

15.10.1 During the construction phase, a watching brief has been recommended (**paragraphs 15.8.3** and **15.8.6** earlier) during any excavation works. A watching brief would enable chance archaeological finds to be recorded, and if such finds are significant, to provide appropriate flexibility in the scheme construction to enable more detailed archaeological recording (i.e. excavation) to be carried out.

16 INTERACTION OF THE FOREGOING

16.1 Introduction

16.1.1 Each of the key natural and human environment parameters of relevance to the proposed schemes have been discussed in the previous sections. Consequently, where an interaction occurs, the impacts are examined within the section relevant to the receptor (i.e. within **Sections 5** to **15**). The following interactions are incorporated in this EIS within the individual sections, and responding to potential changes to the interactions between these topics relevant to the proposed scheme:

- Changes in flooding can affect the local economy and employment;
- Changes in flooding can affect health and safety;
- Changes in traffic can affect air quality, noise and vibration;
- Changes in air quality can affect flora and fauna (both aquatic and terrestrial);
- Changes in aquatic habitat area and type can affect flora and fauna;
- Changes in terrestrial habitat area and type can affect flora and fauna;
- Changes in fish density and diversity can affect recreational activities;
- Changes in sedimentation/erosion can affect in-river habitats, which in turn affects hydrology, which in turn affects aquatic fauna, and recreational activities;
- Changes in river flow and water levels can affect discharges and abstractions;
- Changes in river flow and water levels can affect aquatic flora and fauna, in particular migratory fish;
- Changes in water quality can affect water based recreational activities;
- Changes in water quality can affect fish, particularly migratory species; and
- Changes in landscape can affect recreational amenity.

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17 CONCLUSIONS AND RECOMMENDATIONS

17.1 Conclusions

Summary of Construction Impacts after Mitigation

17.1.1 **Table 17.1** presents in summary form the environmental impacts that would be associated with the construction phase of the proposed River Slaney (Enniscorthy) drainage scheme. The impacts associated with the construction of the proposed scheme are:

- A short-term **moderate negative impact** is predicted on the loss of amenity access during construction.
- A short-term **moderate negative impact** is anticipated on the disruption to traffic during the construction phase.
- A short-term **moderate negative impact** to birds and their habitat (particularly sand martin and kingfisher) will occur for the duration of the works which will be reduced to **no residual impact** on completion of works and providing mitigation measures are successful.
- A temporary **minor to moderate negative impact** to the area around the western end of the bridge in Abbey Square may result from the construction noise for the new footbridge and the demolition of the Seamus Rafter Bridge.
- A short-term **minor negative impact** is anticipated on terrestrial habitats as a result of habitat loss during construction.
- A short-term **minor negative impact** is anticipated from the potential impact to aquatic flora and fauna during construction.
- A potential **minor negative residual impact** on fish would be anticipated in the short-term (i.e. for the one summer duration of the river works) resulting from the river works.
- A potential **minor negative residual impact** on aquatic fauna as a result of sediment re-suspension would be anticipated in the short-term (i.e. for the one summer duration of the river works).
- A **minor negative residual impact** is anticipated to remain in relation to the disturbance of recorded monuments and protected structures.
- A **minor negative residual impact** is anticipated in relation to the disturbance of unknown archaeological sites.
- A short-term **minor negative impact** in relation to the qualifying species features of the cSAC is anticipated but no adverse impact on the integrity of the site is anticipated.
- A short-term **negligible residual impact** would be expected on otters and their habitat during construction.
- A potential short-term **negligible residual impact** on aquatic fauna is anticipated resulting from the risk of contaminant re-suspension and the potential negative effects to the health of fauna species.
- A potential short-term **negligible residual impact** from the disturbance or mobilisation of potentially contaminated sediments would be expected to occur.

- A **negligible residual impact** on water quality is anticipated as a result of increased suspended sediments.
- A potential **negligible residual impact** is likely to remain on water quality, due to the localised re-suspension of material that would occur.
- A **negligible impact** is anticipated at worst from the effects of abstraction and discharge on water quality, reducing to no impact.
- A **negligible impact** on noise receptors in the area is anticipated as a result of the increase in construction traffic on the roads.
- A temporary and short-term **negligible impact** is expected to occur in relation services mainly as a result of raising a road and moving a sewer.
- A **negligible impact** on air quality is anticipated to occur in relation to traffic derived emissions.
- A **negligible impact** is predicted in relation to carbon emissions due to the extended road routing across the new bridge.
- A short-term reversible **negligible impact** to the habitat features of the cSAC designations is anticipated arising from re-suspension of sediments during construction and no adverse impact on the integrity of the site is anticipated.

17.1.2 In all, the construction impacts are significant at times for particular aspects of the environment, however, many of the impacts have been reduced in scale and severity, and all impacts are expected to last for the duration of the works, and in some cases very short durations if they relate to specific elements of work.

Table 17.1 Summary of the Potential Impacts during Construction

Description of Impact	Before Mitigation	After Mitigation
Human Beings		
Disruption to recreational navigation	O	O
Disruption to angling	O	O
Loss of amenity access	×××	×××
Potential traffic disruption to local community	×××	×××
Flora		
Disturbance to designated sites	×××	×
Disturbance to terrestrial habitat	××	××
Disturbance to aquatic habitat	××	××
Disturbance to protected flora species	O	O
Fauna		
Contaminant mobilisation during dredging	×××	×
Sediment re-suspension during dredging	×××	××
Accidental spillage of construction materials	O	O
Disturbance to Qualifying Features of Slaney Valley cSAC	××××	××
Disturbance to otter	××××	×
Disturbance to badgers	O	O
Disturbance to bat roosts	O	O
Disturbance to bat habitat	×××	O
Disturbance to fish	×××	××
Disturbance to birds	×××	O
Disturbance to freshwater pearl mussel	O	O
Soils and Geology		
Soil contamination	××	×
Disturbance to geological deposits	O	O
Water		
Accidental spillage of construction materials	O	O
Sediment re-suspension	××	×
Contaminant mobilisation	××	×
Abstraction and discharges	×- O	×- O
Air, Noise and Vibration		
Construction noise disturbance	××-×××	××-×××
Construction traffic noise disturbance	×	×
Traffic Derived Emissions to Air	×	×
Material Assets		
Disturbance to road network infrastructure	O	O
Disturbance to bridges	O	O
Disturbance to rail network	O	O
Services	×	×
Drainage and outfalls	O	O
Flood risk	O	O
Cultural Heritage		
Disturbance to recorded monuments and protected structures	××××	××
Destruction of unknown archaeological sites	×××	××

Notes:

✓✓✓✓	**Positive Impact (Major)**
✓✓✓	**Positive Impact (Moderate)**
✓✓	**Positive Impact (Minor)**
✓	**Positive Impact (Negligible)**
O	**No anticipated impact**
?	**Potential Impact - could be minor, moderate or major in significance depending on the number of symbols it is linked to.**
×	**Negative Impact (Negligible)**
××	**Negative Impact (Minor)**
×××	**Negative Impact (Moderate)**
××××	**Negative Impact (Major)**
na	**Not applicable**

Summary of Operational Impacts After Mitigation

17.1.3 **Table 17.2** presents a list of the environmental impacts of the proposed River Slaney (Enniscorthy) drainage scheme after successful implementation of the recommended mitigation measures. The following present the long term positive impacts of the proposed scheme:

- The implementation of this scheme would have a **major positive impact** on residential and commercial properties in Enniscorthy by preventing flooding and the associated protection of properties from damage that would otherwise occur in the do-nothing scenario.
- A **major positive impact** is anticipated in terms of offsetting the local economic costs of flood event during the operation of the scheme.
- A **major positive impact** is anticipated on health and safety and loss of life through the prevention of flooding which would otherwise occur if the scheme was not in place.
- A **major positive impact** is anticipated from the prevention of flooding of roads within Enniscorthy as a result of the scheme.
- A **major positive impact** is anticipated through the provision of flood protection to material assets.
- A **moderate positive impact** in relation to stability of the river and its hydrological system is anticipated as a result of the river widening works.
- A **moderate positive impact** on surface water drainage is anticipated to occur from the provision of pumps for use in the event of surface water drainage blockage during extreme flood events.
- A potential **minor to moderate positive impact** is anticipated as a result of the enhancement of otter habitat including the provision of artificial otter holts and the creation of >40ha of additional river and riparian habitat.
- A **minor to moderate positive impact** to fish and their habitat is anticipated as a result of the removal of migratory obstacles during bed re-grading.
- A **minor positive impact** would arise on local employment during the operation of the scheme.

- A **minor positive impact** would occur to the fishery resulting from the improvement in fish passage during the operation of the scheme.
- A **minor negative impact** on traffic is expected as a result of the new bridge as a part of the proposed scheme.
- A **minor positive impact** is predicted on designated sites resulting from the increased otter habitat availability and the obstacle free movement of salmon upstream and downstream.
- A **minor positive impact** on aquatic habitat is anticipated as a result of improvement to habitat diversity and flora resulting from the incorporation of berms.
- A **minor positive impact** on otters and their habitat is anticipated through the reduced risk of inundation to otter holts in the area.

17.1.4 The following present the long term negative impacts of the proposed scheme:

- A **minor negative impact** on visual receptors is anticipated as a result of the installation of flood walls, embankments, the removal of Seamus Rafter Bridge, the new footbridge and the new road bridge.
- A **minor negative impact** to riverside landscape character is anticipated as a result of the scheme.
- A **minor negative impact** is anticipated on floodplain character as a result of the area flooding for only a few days in a hundred years.
- A residual **minor negative impact** on terrestrial habitats is anticipated due to the permanent loss of 4.5ha of neutral grassland.
- A temporary **negligible impact** is predicted from the maintenance works associated with the flood alleviation scheme.
- A **negligible impact** is predicted from operational traffic noise.
- A **negligible impact** on air quality is anticipated to occur as a result of traffic derived emissions during maintenance of the flood alleviation scheme.
- A **negligible impact** on air quality is anticipated to occur as a result of the total traffic emissions in the study area.

17.1.5 There are significant positive impacts for many elements of the human and natural environment that would arise from the proposed scheme being implemented. Although there are a number of negative impacts associated with the scheme, the scale and severity of these is low, particularly in comparison with the positive impacts associated with the scheme.

Table 17.2 Summary of the Potential Operational Impacts

Description of Impact	Before Mitigation	After Mitigation
Human Beings		
Employment	✓✓	✓✓
Economic effects	✓✓✓✓	✓✓✓✓
Health and safety	✓✓✓✓	✓✓✓✓
Disruption to recreational navigation	O	O
Disruption to angling	×××	O
Disruption to emergency access	✓✓✓-×××	O
Loss of amenity access	O	O
Potential traffic disruption to local community & prevention of flooding	✓✓✓✓	✓✓✓✓
Potential deterioration of fishery resource	✓✓	✓✓
Protection of Residential and Commercial Properties from Flooding	✓✓✓✓	✓✓✓✓
New bridge and traffic	×××	××
Flora		
Disturbance to designated sites	✓✓	✓✓
Disturbance to terrestrial habitat	××	××
Gain of Aquatic Habitat	✓✓	✓✓
Fauna		
Disturbance to otter	✓✓	✓✓
Enhancement of otter habitat	✓✓-✓✓✓	✓✓-✓✓✓
Disturbance to badgers	O	O
Disturbance to fish	✓✓-✓✓✓	✓✓-✓✓✓
Disturbance to birds	O	O
Soils and Geology		
Changes to fluvial geomorphology	O	O
Disturbance to geological deposits	O	O
Water		
Sediment re-suspension	O	O
Alteration to Hydrological Regime	××	✓✓✓
Abstraction and discharges	✓	O
Air, Noise and Vibration		
Total Traffic Emissions in the Study Area	×	×
Traffic Derived Emissions to Air during Maintenance of the Proposed Flood Alleviation Scheme	×	×
Noise during maintenance	×	×
Operational traffic noise	×	×
Traffic Emissions at Sensitive Receptors	O	O
Climate		
Climate change		
Landscape		
Obstruction to views	××	××
Alteration to Floodplain Landscape Character	××	××
Alteration to riverside landscape character	××	××
Material Assets		
Surface Water Drainage	✓✓✓	✓✓✓
Flood Protection to Material Assets	✓✓✓✓	✓✓✓✓
Cultural Heritage		
Destruction of known archaeological sites	O	O
Destruction of unknown archaeological sites	O	O

Notes:

✓✓✓✓	**Positive Impact (Major)**
✓✓✓	**Positive Impact (Moderate)**
✓✓	**Positive Impact (Minor)**
✓	**Positive Impact (Negligible)**
O	**No anticipated impact**
?	**Potential Impact - could be minor, moderate or major in significance depending on the number of symbols it is linked to.**
×	**Negative Impact (Negligible)**
××	**Negative Impact (Minor)**
×××	**Negative Impact (Moderate)**
××××	**Negative Impact (Major)**
na	**Not applicable**

Summary of Appropriate Assessment

17.1.6 Impacts to the Slaney Valley cSAC were examined in the Appropriate Assessment presented in **Appendix 5** of this EIS. A summary of the findings are presented in **Table 17.3**. Overall, the impacts that would arise to the aquatic habitat and fauna would occur during construction. However, no direct (or indirect) impacts are identified on the habitats for which the site is designated, and conservative estimate of the potential impact on interest species shows that sufficient mitigation measures (and further agreement of those with NPWS) should ensure that only a minor short-term impact occurs, and this **would not adversely affect the integrity of the cSAC**. In the long term the scheme will provide additional habitat for many of the cSAC interest species.

Table 17.3 Summary of Appropriate Assessment

Feature	Impact
Migratory fish features (*Salmo salar, Alosa fallax, Alosa alosa, Petromyzon marinus, Lampetra fluviatilis, Lampetra planeri*)	Short-term minor negative impact resulting from construction activities.
Otter (*Lutra lutra*)	Short-term reversible negligible impact through disturbance to two holts and disruption to foraging access.
Floating vegetation	Short-term reversible negligible impact arising from re-suspension of sediments during construction and no impact during operation.
Old sessile oak woodlands	No impact.

17.2 Recommendations

The Proposed Scheme

17.2.1 The proposed scheme will provide a significant flood protection benefit to the community and assets of Enniscorthy, which would be felt across a much wider area, in particular in relation to traffic and access protection. The scheme as designed minimises or could be refined to avoid many negative impacts, such that the benefits considerably outweigh the negative aspects of the scheme.

Further Works in Detailed Design Phase

17.2.2 In order to avoid or prevent negative impacts occurring both as a result of the scheme in the long term or during its construction, due to the limited detailed design and methodological data for the scheme available at the stage of preparation of this EIS, a range of further works and consultations are recommended. These further works should be carried out in the Detailed Design Phase, which would if permission were granted for the proposed scheme. The following further works are considered essential:

- In relation to the Seamus Rafter bridge replacement the details of junction design will be determined during the Detailed Design Stage, to ensure the junctions give due consideration to traffic flows, junction size, junction capacities, possible need for realignment of existing approach roads to provide deflection angles/right turn lanes, and use of junction by pedestrians and cyclists. These details will be designed and agreed with the National Roads Authority, Wexford County Council, and Enniscorthy Town Council.
- With regard to the Diversion Channel weir crest level, in order to ensure the accuracy and flexibility for existing water levels and design flood water levels, as well as the potential changes to these as a result of climate change, discussion and agreement of the appropriate crest level will be discussed and agreed with the Eastern Regional Fisheries Board (ERFB) and National Parks and Wildlife Service (NPWS) during the Detailed Design Phase.
- With regard to fish pass design, in order to ensure the adequacy of the fish pass and the avoidance or minimisation of impacts on the aquatic environment including flora and fauna, it is recommended that the Detailed Design is discussed and agreed with the Eastern Regional Fisheries Board (ERFB) and National Parks and Wildlife Service (NPWS).
- As no design details were available at this stage, during the Detailed Design Phase the footbridge design and construction elements should be confirmed with Enniscorthy Town Council, and any change in the environmental effects confirmed with the ERFB and NPWS.
- A sediment quality survey should be undertaken to identify potentially contaminated land and riverbed deposits (albeit targeted at fine-grained sediments such as silts and fine sands) during the Detailed Design Phase and prior to construction. Depending on the results of this survey a materials management strategy may also need to be produced and developed in consultation with the EPA and Wexford County Council, in order to identify appropriate reuse, recycling recovery or disposal of any material (and it's quality) in an appropriate and licensed manner.
- With regards to the new bridge crossing the existing rail line at the southern end of Enniscorthy, during Detailed Design of the bridge and bridge construction method, agreement must be received with Iarnrod Eireann regarding the proposed works method and design. In addition, this consultation and agreement should also include the works programme and procedures and agreement over temporary suspension of use during key stages of the bridge works that would need to be undertaken as a result of health and safety requirements.
- The methodology and materials to be used in the bridge underpinning works as part of the river bed re-grading work will be agreed with the National Roads Authority, Iarnrod Eireann and Wexford County Council prior to the commencement of construction and in the Detailed Design Phase, to ensure that no stability or structural disturbance occurs. Initial stages of the Detailed Design should include a

structural survey of both bridges (the Railway Bridge and Enniscorthy Bridge) to inform the design.

- During the Detailed Design Phase of the railway bridge and bridge construction method, agreement must be received with Iarnrod Eireann regarding the proposed works method and design. In addition, this consultation and agreement should also include the works programme and procedures and agreement over temporary suspension of use during key stages of the bridge works that would need to be undertaken as a result of health and safety requirements.
- Tie in of the flood wall to the side of Enniscorthy Bridge, as shown on Figure 3.13. The bridge is a protected structure and any significant disturbance must be warranted. However, during the Detailed Design Phase consultation with the Department of Environment, Heritage and Local Government and Wexford County Council will ensure that the disturbance to the bridge structure and facing would be minimised by this work.
- Archaeological evaluation should be carried out by a suitably qualified and licensed archaeological contractor to identify whether any archaeological features or finds or preservational horizons are present, and hence evaluate the significance of potential impacts, if any. This evaluation should be undertaken along the line of the river widening locations and after agreement with the Department of Environment, Heritage and Local Government. If no features or archaeological horizons are identified during trial pits, a watching brief should be carried out during river widening works.
- During the Detailed Design Phase it will be necessary to clarify and confirm with the EPA whether the use of river bed or river widening material for the flow deflectors on the meadows upstream of the Railway Bridge will require a licence under the Waste Management Act 1996. The licence would need to be sought from the EPA for both disposal to land, as well as the discharge of water from bed and river widening material.
- To ensure that there are no increases in low flow velocities as a result of the river re-grading works, the Detailed Design Phase shall incorporate a specific low flow channel within the re-grading works design. The dimension of this channel will be derived from hydrographic readings of water levels from which flow volumes can be derived to determine the 5% flow rates. Based on these, a low flow channel cross-section will be designed, and a low flow channel route identified on the Detailed Design plans. The design of the low flow channel will be discussed and agreement gained with the Eastern Regional Fisheries Board, as well as consultation undertaken with interested parties, such as the Slaney River Trust.

Mitigation Measures

17.2.3 Provided adequate detailed work and studies are carried out in the Detailed Design Phase, along with the consultation recommended with the various statutory and non-statutory organisations, the implementation of the following mitigation measures should combine to significantly avoid or minimise the potential negative impacts of the proposed scheme:

- During construction the Eastern Regional Fisheries Board “in-river works closed season” should be adhered (October to April).
- Provision of two artificial holts to provide alternative habitats use for otters, which should be available for use by otters before the construction period commences.

- No works to be undertaken within 150m of any holts at which breeding females or cubs are present.
- No wheeled or tracked vehicles (of any kind) should be used within 20m of active, but non-breeding, otter holts.
- Light work, such as digging by hand or scrub clearance should also not take place within 15m of such holts, except under licence;
- The prohibited working area associated with otter holts should, where appropriate, be fenced (in accordance with Clause 303 of the NRA's Specification for Roadworks) with temporary fencing prior to any possibly invasive works.
- All contractors or operators on site should be made fully aware of the procedures pertaining to each affected holt;
- Where holts are present in close proximity to invasive construction works but are determined not to require destruction, construction works may commence once recommended alternative mitigation measures to address otters have been complied with; and
- River widening works should be undertaken one bank at a time to ensure foraging access at all times during the construction period.

- Depending on the requirements that come out from the Detailed Design Phase in relation to the sediment and material management, the use of silt screens, or enclosing areas to work in the dry, excavating riverbanks during periods of low water level, and other measures should be employed to prevent the release of large quantities of sediment at one time.
- With regards to the new bridge and traffic routing the following measures should be examined fully in the Detailed Design Phase, and agreed with the NRA, Wexford County Council, and Enniscorthy Town Council:
  - The possibility of providing double yellow lines along the N30 Waterford Road near the new bridge connection and section of the road should be considered in order to prevent possible obstruction and congestion;
  - The possibility of relocating the school's access should be considered, in order to prevent obstruction and congestion; and
  - The number and type of junction arrangements which would be the most appropriate both from the and onto the new bridge, as well as those junctions in close proximity along the N30; and
  - To alleviate the volume of traffic approaching the town from the Dublin Road N11 northern approach and having to perform a 'u-turn' to access the town centre it is proposed to sign-post the town centre from Blackstoops roundabout. The signs should direct traffic to access the town centre via the Summerhill / Nunnery Road.
- Due to fisheries constraints it is not possible to time construction to avoid the breeding bird period (March to September). In order to reduce impacts to breeding birds it will be necessary to make the sandbank unsuitable for sand martin before the breeding bird period (i.e. between October and February).
- Minimise the risk of significant spill and/or leak by following standard good practice with regard to pollution prevention as part of the appointed contractor's environmental management plan. It is also recommended that any concrete pouring

and filling works are monitored by the appointed contractor and spill prevention and remediation measures are in place to minimise the risk and extent of spills and to rapidly deploy clean up equipment.

- No specific construction noise mitigation are suggested, but Best Practice would suggest that the principles of Best Practicable Means (BPM), as defined in BS 5228, should be applied to all on-site construction activities.
- Before commencement of construction an agreement should be reached between the principal contractors and the local authority as to the suitable construction methodologies to be used, working hours and plant and noise limits and monitoring as appropriate.
- It may be necessary to provide screening to significantly noisy activities such as breaking out of the foundations of the Seamus Rafter Bridge and piling for the new footbridge. Any requirement to operate percussion piling rigs or breakers outside the standard hours of 07:00 to 19:00 Monday to Friday should be agreed with the local authority beforehand.
- In addition, further qualitative mitigation in the form of timely and effective public relations can be applied so that residents in Enniscorthy are kept informed of ongoing and future construction operations.
- Mitigation of traffic noise from the elevated road on the new bridge to the south of the Riverside Park Hotel could take the form of reducing the source noise, increasing the noise attenuation of the transmission path or treatment at the receiver.
- Reducing the source noise directly emitted by individual vehicles passing over the bridge could be achieved by laying a low noise road surface across the bridge, reducing noise emitted from the tyre/road interface.
- Mitigation at the receiver could take the form of insulation of walls and windows on the southern façade of the hotel. The level of insulation required would depend on the uses of the rooms at the southern end of the hotel, bedrooms requiring the most attenuation.
- Grass seeding of the flood flow deflector bunds to the north of the Railway Bridge to speed up their recolonisation.

Mitigation during Operation

17.2.4 To ensure that there are no increases in low flow velocities as a result of the river re-grading works, the Detailed Design Stage shall incorporate a specific low flow channel within the re-grading works design. The dimension of this channel will be derived from hydrographic readings of water levels from which flow volumes can be derived to determine what the 5% flow rates are. Based on these, a low flow channel cross-section will be designed, and a low flow channel route identified on the detailed scheme design plans. The design of the low flow channel will be discussed and agreement gained with the Eastern Regional Fisheries Board, as well as consultation undertaken with interested parties, such as the Slaney River Trust.

Monitoring

17.2.5 The following monitoring measures have been identified as a means of confirming the assessment within this EIS, or in rare cases, of reactive measures that are the only realistic method to cope with 'surprise' events and effects during the construction of the proposed scheme:

- Should the salmon fishery re-open in the future years after 2009, the monitoring of fish catches should be undertaken. This could be carried out by contacting the local fishing clubs and owners, and yearly (for a period of three years) after construction is completed a meeting will be held with the interested groups to ensure that no significant changes have occurred. Consultation should also include the ERFB, whose monitoring would also be included in the discussions. If a significant deterioration in salmon numbers in particular is recorded, in cooperation with the ERFB, the OPW would undertake to study the problem and undertake corrective works if related to specific aspects of the proposed scheme.
- Following the completion of the bridge and road works, traffic counts and should be undertaken to ensure that there are no unexpected areas of congestion in the road traffic network. The work should be undertaken in co-ordination with Wexford County Council, who has the traffic model and previous count data.
- A habitat survey is to be undertaken one year after construction is completed to ensure that habitat and flora species are responding and re-colonising appropriately. Monitoring of features related to the cSAC are focussed on the faunal species which exploit the habitat (namely fish species and otter) and monitoring for these is proposed in **Section 7.10**.
- As noted in **Section 5.10** there is a requirement to maintain monitoring of recreational angling for three years after construction. There is, overall, a requirement for the OPW (in collaboration with ERFB) to utilise the monitoring of migratory and spawning fish (particularly salmon, shad, and lamprey) within the study area to ensure that the long term improvements anticipated from the scheme are occurring. It is expected that monitoring would occur for three years after completion of the scheme, and each year a discussion of the results would be undertaken with NPWS and ERFB.
- Other than water quality monitoring that may be required as part of the waste licensing procedures, no other monitoring is required.
- During the construction phase, a watching brief has been recommended (**paragraphs 15.8.3** and **15.8.6**) during any excavation works. A watching brief would enable chance archaeological finds to be recorded, and if such finds are significant, to provide appropriate flexibility in the scheme construction to enable more detailed archaeological recording (i.e. excavation) to be carried out.

17.3 Formal Consultations and Permissions/Licences

17.3.1 Prior to the works, two licences may be required:

- A licence to disturb (or potentially disturb) otter during construction may be needed (to be confirmed following discussion with NPWS in the Detailed Design Phase); and
- A possible waste management licence for material disposal or reuse (to be confirmed following discussion with the EPA in the Detailed Design Phase).

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GLOSSARY

Ambient Noise: totally encompassing sound in a given situation at a given time usually a composite of sounds from many sources near and far.

Amenity: the attributes which create and influence the quality of life of individuals or communities, such as environmental conditions, physical, social, recreational or cultural features.

Aquifer: a body of permeable material (e.g. rock, gravel or sand) containing significant amounts of groundwater.

Attenuation, Sound: a reduction in the intensity or level of a sound signal.

A – Weighting: The sound pressure level determined when using the frequency-weighting network A. The human ear has a non-linear frequency response; it is less sensitive at low and high frequencies and most sensitive in the range 1 to 4 kHz. The A-weighting is applied to measured or calculated sound pressure levels so that these levels correspond more closely to the response of the human ear. A change of 3 dB(A) is the minimum perceptible under normal conditions, and a change of 10 dB(A) corresponds roughly to halving or doubling the loudness of a sound.

Background Noise Level ($L_{A90,T}$): the 'A' weighted noise level exceeded for 90% of the specified measurement period (T). In BS 4142: 1990 it is used to define background noise level.

Baseline Studies or Survey: the collection of information about the environment which is likely to be affected by the project.

Berm: a ledge at the bottom of the river bank.

Biodiversity: the richness and variety of wildlife and habitats in a given area.

Catchment (also hinterland): the area from which customers are drawn for any particular service or facility, also the area of land drained by or into a watercourse.

Character: the distinguishable or recognisable identity, impression or expectation of a particular place or area created by its particular innate properties including sights, sounds and activities.

Conservation: the regulation of change to ensure the preservation and enhancement of built and natural features of acknowledged importance or interest.

Decibel (dB): the unit of sound intensity. It is derived from the logarithm of the ratio between the value of a quantity and a reference value. The threshold of normal hearing is in the range of 0 - 140 dB, the upper limit being the threshold of pain. A change of 1 dB is only perceptible under controlled conditions.

Development: all building, engineering, mining or other operation in, on, over or under land; or any material change of use in buildings or land.

Environmental Impact Assessment (EIA): EIA applied at the project level is a process intended to ensure that environmental impacts of schemes are identified prior to the work being carried out so that proposals can be modified or managed in such a way that adverse impacts are avoided or minimised and the positive impacts maximised. The extent of the likely significance of environmental impacts is assessed, as far as it can be determined from an early stage, using three categories of significance (1) major, (2) moderate and (3) minor.

Environmental Impact Statement (EIS): the document produced to assess and describe the environmental impacts of a project subject to EIA under the EIA Regulations. The EIS is a consultation document and sets out mitigation and enhancement measures for the project.

Facade Noise: A noise level measured or predicted close to the façade of a building, typically at a distance of 1 m. It contains a contribution from noise reflected from the façade.

Fauna: animal life.

Floodplain: lowlands bordering a river which are subject to flooding.

Flora: plant life.

Fluvial: relating to or occurring in a river or stream.

Free-field: An environment in which there are no reflective surfaces within the frequency region of interest.

Geomorphology: pertaining to landforms, their structure, origin and development.

Geotechnical: the application of the science of soil mechanics, rock mechanics, engineering geology and other related disciplines to engineering and environmental projects.

Groundwater: water occurring below ground, occupying openings, cavities and spaces in rocks.

Habitat: the natural home of an animal or plant (providing food, water, shelter etc.).

Hard defence: a flood defence structure constructed from concrete, stone, brick or other hard materials.

Holt: home of an otter, often associated with a hole in the ground, usually in the roots of a bankside tree.

Hydraulic: the analysis of water movement, for example calculating flood water levels.

Hydrodynamic: the analysis of water flow allowing for the dynamic changes in flow condition with time.

Hydrology: the calculation of flow rate and volume within the catchment.

Hydrogeology: the science of water within the ground.

Infrastructure: the necessary basic services on which all development depends, for example, sewerage, drainage, water, electricity, roads, etc.

($L_{Aeq,T}$) Equivalent Continuous A-Weighted Sound Pressure Level: the equivalent continuous sound level - the sound level of a notionally steady sound having the same energy as a fluctuating sound over a specified measurement period (T). $L_{Aeq,T}$ is used to describe many types of noise and can be measured directly with an integrating sound level meter. This parameter allows a description to be made of fluctuating noise levels (eg. those associated with railway noise), in terms of a single sound level over the same exposure period. The time period must be given with L_{Aeq} values, for instance, $L_{Aeq.18h}$ is used to describe the equivalent `continuous' sound level of trains passing during the period 0600 hours to midnight.

$L_{A10,T}$: The A-weighted sound pressure level of non-specific noise at the measurement location that is exceeded for 10% of the given time period, T.

L_{den} : The day-evening-night composite noise indicator for overall annoyance adopted by the EU, and as defined in the Environmental Noise Regulations (SI 140/2006).

Landscaping: a general term used for the means by which development is made to fit visually into its surroundings by use of space and control of siting and layout and use of trees, shrubs or grass (soft landscaping) and / or fences, walls or paving (hard landscaping).

LAT: lowest astronomical tide level, this is the lowest level reached by a low tide during one year.

Microclimate: the climate within a few metres of the ground and in a relatively small area.

Mitigation Measures: steps that may be taken to minimise, eliminate or compensate the adverse effects of a development.

NO_2: nitrogen dioxide with two oxygen molecules linking to one of nitrogen.

Notion al Capacity: the expressed capacity by which facilities may operate at 100% efficiency, beyond this capacity inefficiencies become apparent. Full capacity is predicted to be 25% greater than the notional capacity.

Open Space: an area of land, regardless of ownership, upon which no significant built development has taken place or from which such development has been removed.

ppb: an expression of concentration in air or water, in terms of the number of molecule parts per billion

PM10: fine particulate matter often associated with traffic emissions.

Planning Conditions: planning permission for development may be conditional on other work or undertakings being carried out by the developer, provided they are reasonable and justifiable in planning terms.

Planning Permission: the prior, written consent of the Local Planning Authority which all development, except permitted development, must have before commencement and which may expire within a certain time period.

Royal Haskoning: environmental (and engineering) consultants appointed by the developer to carry out the environmental scoping and assessment exercises, formerly called Posford Haskoning.

Recreation (Formal and Informal): leisure time physical activities. Formal recreation activities usually require special equipment or 'fixed' facilities, advance organisation and encompasses most sports. Informal recreation usually requires little, if any, special public provision or 'fixed' facilities and is usually capable of being undertaken on a spur of the moment basis by individuals or groups.

Remediation: for contaminated soil – the process of treating the soil to a standard to allow it to remain on site and not pose a risk to human health or controlled waters.

Scoping: the process of explaining the nature and likely impacts of a project, identifying stakeholders and defining how the EIA process will be carried out.

Settlement: a well-defined grouping of buildings, predominantly residential but including other uses, which have a recognisable form or identity or function and a common place name.

Soft defence: an earth bank flood defence structure.

Siltation: accumulation of silt (fine mud, clay etc.).

Sound Pressure Level: Sound pressure level, in decibels, is the weighted sound pressure level obtained by use of a sound-level meter. The reference pressure is 20 µPa, unless otherwise stated.

Spawn: to lay eggs (of fish and amphibians).

Spraint: otter faeces.

Sustainable Development: that which meets the needs of the present without compromising the needs of the future.

Two-stage channel: natural rivers almost always form two stages, a main "bankfull" channel and a floodplain. For this project a secondary channel can be created that will contain flows when the main channel is overtopped.